



RUNWAY SAFETY GUIDANCE MANUAL

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0.1 Foreword

This Manual provides guidance to Aerodrome Operator and Air Navigation Services providers in establishing a system for preventing runway incursions and excursions.

Such a system is intended to ensure that the operational procedures on the aircraft manoeuvring areas follow standards stipulated in this Manual and as appropriate to the Civil Aviation (Aerodromes Design and Operation) Regulations and the Civil Aviation (Air Traffic Services) Regulations, as amended.

Amendment to this Manual is the responsibility of the Director General Civil Aviation and readers should forward advice on errors, inconsistencies, or suggestions for improvement to the Director General Civil Aviation at the following address:

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0.3 Records of Amendments

NR/Year	Publication Date	Amended Pages	Inserted by

0.4 Abbreviations

ACFT	-	Aircraft
ADP	-	Airside Driving Permit
ARIA	-	Aerodrome Runway Incursion Assessment
ATM	-	Air Traffic Control
ATIS	-	Automatic Terminal Information Service
ATM	-	Air Traffic Management
ATS	-	Air Traffic Services
CP	-	Closest Proximity
FOD	-	Foreign Object Debris
L	-	Left
NOTAM	-	Notice to Airmen
PANS -		Procedures for Air Navigation Services
R	-	Right
RISC	-	Runway Incursion Severity Classification
RTF	-	Radiotelephony
RVR	-	Runway visual range
RWY	-	Runway
SARPs -		Standard and Recommended Practices
SMS	-	Safety Management Systems
SSR	-	Secondary Surveillance Radar
CAA	—	Civil Aviation Authority
UHF	-	Ultra-High Frequency
VHF	-	Very-High Frequency

0.5 Definitions

Accident. An unintended event or sequence of events that cause death, injury, environmental or material damage.

Aerodrome. A defined area on land (including any buildings, installations, and equipment) used for the arrival, departure and surface movement of aircraft.

Aircraft. Any machine that can drive support in the atmosphere from the reactions of the air other than the reactions of the air against the earth's surface.

Airside. The movement area of an airport.

Apron. A defined area, on a land Aerodrome, intended to accommodate aircraft for purposes of loading or unloading passengers, mail or cargo, fuelling, parking, or maintenance.

Clearway. A defined rectangular area on the ground or water under the control of the appropriate authority, selected or prepared as a suitable area over which an airplane may make a portion of its initial climb to a specified height.

Harm. The loss to a human being or to a human population.

Hazard. A physical situation, often following from some initiating event, that can lead to an accident.

Hot Spot. A location on an Aerodrome movement area where there is an increased risk of collision or runway incursion.

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.

NOTAM or Notice to Airmen. A notice distributed by means of telecommunication containing information concerning the establishment, condition or change in any aeronautical facility, service procedure or hazard, the timely knowledge of which is essential to personnel concerned with Flight Operations.

Risk. The chance of something happening that will have an impact upon objectives. It is measured in terms of consequences and likelihood.

Risk Analysis. A systematic use of available information to determine how often specified events may occur and the magnitude of their consequences.

Risk Assessment. The overall process of risk analysis and risk evaluation.

Risk Mitigation. The process of incorporating defences or preventive controls to lower the severity and/or likelihood of a hazard's projected consequence.

Runway. A defined rectangular area on a land Aerodrome prepared for the landing and take-off of aircraft.

Runway Confusion. An error when an aircraft makes "unintentional use of a wrong runway or taxiway for landing or take-off".

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.

Note: In the context of Runway Incursions, the protected area of a surface designated for the landing and take-off of aircraft is comprised of:- the runway; the stopway; the Runway End Safety Area (RESA); the area along each side of the runway whose width is the runway-holding position distance; and, if provided, the clearway.

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

Runway End Safety Area (RESA). An area symmetrical about the extended runway centre line and adjacent to the end of the strip primarily intended to reduce the risk of damage to an aeroplane undershooting or overrunning the runway.

Runway Incursion Severity Classification (RISC) Calculator. Computer program that classifies the outcome of runway incursions.

Runway Safety Team. A team comprised of representatives from [the Aerodrome Operator], Air Traffic service providers, airlines or aircraft operators, Pilot and Air Traffic Controllers' associations and any other group with a direct involvement in runway operations [at a specific Aerodrome], that advise the appropriate management on the potential runway [safety] issues and recommend mitigation strategies.

Note: This definition is based on ICAO Doc 9870 – Manual on the Prevention of Runway Safety Incursions but takes into consideration evolving concepts resulting from recent work of the ICAO Runway Safety Program. It therefore slightly improves the original definition without contradicting but rather clarifying it for the purposes of this document. It may or may not be eventually harmonized in other publications, based on feedback on its use. For easy identification, the differences are as shown between square brackets.

Safety. The state in which risks associated with aviation activities, related to, or in direct support of the operation of aircraft, are reduced and controlled to an acceptable level.

Safety Management System (SMS). A systematic approach to managing safety, including the necessary organizational structures, accountability, responsibilities, policies and procedures.

Safety Risk. The predicted probability and severity of the consequences or outcomes of a hazard. Safety risk probability. The likelihood or frequency that a safety consequence or outcome might occur.

Safety Risk Severity. The extent of harm that might reasonably occur as a consequence or outcome of the identified hazard.

State Runway Safety Programme (RSP). An integrated set of regulations and activities aimed at improving runway safety.

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

Stopway. A defined rectangular area on the ground at the end of take-off run available prepared as a suitable area in which an aircraft can be stopped in the case of an abandoned take-off.

1.0 BACKGROUND TO RUNWAY INCURSION

1.1 Introduction

The applicable Civil Aviation (Aerodromes Design and Operation) Regulations, requires Category A aerodrome operators to implement Safety Management System, as a part of the Aerodrome certification process. (Obligations of aerodrome operator) make it imperative for the aerodrome to put in place procedures for the safe and orderly operation of aircraft on the runway and other areas (SME to apply a correct reference).

The Civil Aviation (Air Traffic Services) Regulations, as amended requires the Air Navigation Services provider to establish runway safety programmes to enhance runway safety using collaborative approach that involves; regulators, aircraft operators, aerodrome operators and air navigation service providers.

The prevention of runway incursions and excursions is a part of safety Management System efforts implemented by the aerodrome operator, the air navigation services provider and the air operator. Competent operational personnel are the primary contributors of the aviation safety system. Care must be taken to avoid falling into the pitfall of focussing safety efforts on organizational issues exclusively, to the detriment of the human contribution to success and failure of the aviation safety system.

Active failures by aerodrome operational personnel and providers of air navigation services are sometimes bred by flaws in the system, sometimes by well-known and documented human limitations, most times by a combination of both. A systemic approach to safety must encompass consideration of latent conditions in the system as well as active failures on the front lines of operations. Such a systemic approach underlies this guidance material for the prevention of the runway incursions and excursions.

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”.

The US Federal Aviation Administration (FAA) defines runway incursion as “any instance on a runway involving an aircraft, vehicle, person, or object that creates a collision hazard or results in loss of required separation with an aircraft preparing to take off or land. (The term “loss of required separation” refers to the loss of minimum safe distances between aircraft and other objects on the runway surface.)

1.2 Purpose of this Guidance Material

While runway safety takes into account issues such as foreign objects, debris and animals straying onto the runway and other logistical deficiencies, this guidance material specifically addresses the subject of runway incursion and excursion 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 excursions and the potential for collisions to be the most significant risk in aerodrome operations. Successful prevention of runway incursions and excursions requires the collaboration of air traffic controllers, pilots, vehicle drivers and aerodrome management.

This guidance material also aims primarily, to provide guidance for implementation of local runway safety programmes. Such initiatives aim to remove hazards and mitigate risks of runway incursions and excursions, to reduce active failures and severity of their consequences. In all aspects of this guidance material, the principles of Safety Management Systems (SMS) will be used to mitigate or eliminate the hazardous factors.

Beginning with causal factors, the guidance material looks to further explore the factors resulting in runway incursions. Initiatives are also identified that aircraft and aerodrome operators, air navigation service provider can adopt to remove hazards, mitigate risks and create a cooperative, effective and safe operational environment.

Much can be learned by analyzing previous incidents and accidents. A standardized runway incursion/excursion report form and a runway incursion/excursion causal and contributory factors identification form by State are included which will allow a national approach to data collection. The forms are included in this Manual as Appendix F and G. Comprehensive analyses of data are essential to distinguish trends, causal factors and develop cost-effective risk reduction strategies.

A runway incursion severity classification (RISC) model is an indispensable tool for assessing risks. The use of this RISC model will enable a consistent assessment to be made of the severity of runway incursion events.

1.3 Prevention of Runway Incursion

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

Aviation safety programmes have a common goal – to reduce hazard, mitigate and manage risks 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.

Several States and international organizations have embarked on extensive programmes to reduce the risk of runway incursions. Reports indicate that a number of factors were likely to be responsible for the continuing increased trend in runway incursions, including traffic volume, capacity-enhancing procedures, and aerodrome design. It has been concluded that:

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

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

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

increasing environmental pressure to compromise Safe Air Traffic Management (ATM) practices by requiring too many configuration changes.

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

The Aerodrome Inspectors are responsible for verification on the degree of implementation of runway safety programmes.

1.4 Prevention of Runway Excursions

1.4.1 About one in every five excursions occurs on takeoff. There are two types of runway excursions: veer offs (going off the side of the runway) and overruns (going off the end of the runway).

1.4.2 All organisations that are involved in aviation play a role in reducing the risk of runway excursions. These include aircraft manufacturers, operators, airports, regulators, and air traffic management (ATM).

1.4.3 ATM plays a significant role in any issue dealing with the runway and runway safety. ATM has two primary roles in reducing the risk of landing runway excursions: provision of stabilized approaches assistance to crew and provision of timely and the most accurate information available concerning winds, weather conditions and runway conditions to aircrew.

1.4.4 Approach and landing is the highest risk phase of flight for all categories of aircraft. Data has shown that stabilized approaches are critical to all aspects of approach and landing accident reduction.

1.4.5 A stabilized approach is defined by parameters established by operators that include the intended flight path, speed, power setting, aircraft attitude, sink rate, configuration, and crew readiness.

1.4.6 There are several reasons why an approach may be unstable. These reasons can be attributed to the aircrew, the aircraft, the ATM, the environment conditions, or a combination of these factors.

1.4.7 All flights must be stabilized by 1,000 feet above airport elevation in instrument meteorological conditions (IMC) and by 500 feet above airport elevation in visual meteorological conditions (VMC).

1.4.8 The following are the recommended elements of a stabilized approach:

- a) The aircraft is on the correct flight path.
- b) Only small changes in heading/pitch are required to maintain the correct flight path.
- c) The aircraft speed is not more than landing reference speed (VREF) +20 knots indicated air speed and not less than VREF.
- d) The aircraft is in the correct landing configuration.
- e) Sink rate is no greater than 1,000 feet per minute. If an approach requires a sink rate greater than 1,000 feet per minute, a special briefing should be conducted.
- f) Power setting is appropriate for the aircraft configuration and is not below the minimum power for approach as defined by the aircraft operating manual.
- g) All briefings and checklists have been conducted.
- h) Specific types of approaches are stabilized if they also fulfil the following:
 - i. Instrument landing system (ILS) approaches must be flown within one dot of the glideslope and localizer;
 - ii. a Category II or Category III ILS approach must be flown within the expanded localizer band;
 - iii. during a circling approach, wings should be level on final when the aircraft reaches 300 feet above airport elevation; and
 - iv. Unique approach procedures or abnormal conditions requiring a deviation from the above elements of a stabilized approach require a special briefing.

2.0 FACTORS CONTRIBUTING TO RUNWAY INCURSION

2.1 Background

2.1.1 Pilots, controllers and drivers may each be involved in runway incursions. Mitigation strategies that address all three parties will be included in systemic solutions.

As noted previously runway incursions may be a result of many contributory factors. Analysis of the occurrence can be executed using the SHEL Model (sometimes referred to as SHELL Model). Importantly, the SHEL Model draws attention not to these 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 represents the Human/Machine Interface (HMI) issues. The contributory factors described in this chapter (normally designated as Live ware by the SHEL model) do not exclude contributions from the other aspects of organizational factors, e.g. policies, procedures, environment, but which are critical factors associated with Safety Management Systems and which must be addressed to improve overall safety.

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 of communication leading to a failure to follow an air traffic control instruction; and
- f) An aircraft passing behind an aircraft or vehicle that has not vacated the runway.

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

2.2 Communication Breakdowns that May result in Runway Incursions

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

- a) Use of non-standardized phraseology;
- b) A failure by the pilot or the vehicle driver to provide a correct read-back of an instruction;
- c) The controller does not ensure that the read-back by the pilot or the vehicle driver conforms with the clearance issued;
- d) Pilot and/or vehicle driver misunderstanding the controller's instructions;
- e) Pilot and or vehicle driver accepting a clearance intended for another aircraft or vehicle;
- f) Blocked and partially blocked transmissions; and
- g) Long or complex transmissions.

See Appendix A for more detailed guidance on Communication Best Practices.

2.3 Pilot factors that may result in runway incursions

These may include

- a) inadvertent noncompliance with ATM clearances.
Often these cases result from a breakdown in communication or a loss of situational awareness in which a pilot thinks that he/she is 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.
- b) Inadequate signage and markings (particularly the inability to see the runway holding position lines);
- c) Controllers issuing instructions as the aircraft is rolling out after landing (when pilot workload and cockpit noise are both very high);
- d) Pilots have to perform mandatory head down tasks, which reduce situational awareness;
- e) Pilots being pressed by complicated and/or capacity enhancement procedures, leading to rushed behaviour;
- f) Complicated airport design where runways have to be crossed;
- g) Incomplete, nonstandard or obsolete information about the taxi routing to expect; and,
- h) Last minute changes by ATM in taxi or departure routings.

See Appendix B for more detailed guidance on Flight Crew Best Practices including the sterile flight deck concept.

2.4 Air Traffic Control Factors that May Result in Runway Incursions

2.5 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) crossing clearance issued by a ground controller instead of air/tower controller;
- e) misidentifying an aircraft or its location;
- f) failure by the controller to provide a correct read-back of another controller's instruction;
- g) failure by the controller to ensure that read-back by the pilot or the vehicle driver conforms with the clearance issued;
- h) communication errors;
- i) over long or complex instructions;
- j) use of non-standard phraseology; and
- k) reduced reaction time due to on the job training.

2.6 Other common factors include:

- a) Distraction;
- b) Workload;
- c) Experience level;
- d) Inadequate training;
- e) Lack of 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.

2.7 Airside Vehicle driver Factors that may result in runway incursions

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

- a) Failure to obtain clearance to enter the runway;
- b) Not complying with ATM instructions;
- c) Inaccurate reporting of position to ATM;
- d) Communication errors;
- e) Inadequate training for airside vehicle drivers;
- f) No radiotelephony equipment;
- g) No 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 communication.

2.8 Aerodrome Design Factors

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.

Common factors include:

- a) Complexity of airport layout including roads and taxiways adjacent to the runway;
- b) Not enough 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 ICAO *Aerodrome Design Manual* (Doc 9157) for more detailed guidance on aerodrome design.

3.0 ESTABLISHING RUNWAY INCURSION PREVENTION PROGRAMME

3.1 Local Runway Safety Teams

- 3.1.1 A runway incursion prevention programme should start with the establishment of local runway safety teams at individual aerodromes. The primary role of a local runway safety team, which may be coordinated by Safety Manager responsible for Safety Management System, who should develop an action plan for runway safety, advise the appropriate management on the potential runway incursion issues and to recommend strategies for hazard removal and mitigation of the risks. These strategies may be developed as a result of local occurrences or combined with information collected elsewhere.
- 3.1.2 The team could comprise representatives from aerodrome operations, air traffic service providers, airlines or aircraft operators, pilot and air traffic controller associations and any other groups with a direct involvement in runway operations. The team should meet on a regular basis. Frequency of meetings should be determined by the individual groups.
- 3.1.3 At some aerodromes, other groups may already exist that could carry out the functions of a runway safety team.

3.2 Goals and General Description of the RST Programme

- 3.2.1 The primary role of a runway safety team is to advise relevant operators and service provider's management and operational staff on prevailing local conditions on the runway, taxiways and adjacent areas, other issues of concern and develop mitigating measures and solutions to identified issues.
- 3.2.2 The RST should implement an action plan for runway safety, advise management as appropriate on potential runway safety 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.
- 3.2.3 Although not considered a regulatory authority or intended to replace any required component of a Safety Management System (SMS), the RST is aimed to improve and support runway safety by integrating the safety systems of the participating organizations (stakeholders). Interfacing service providers should document the interface between the SMS and the RST, where RSTs are available. RSTs can serve as an excellent tool for managing runways safety related risk identified by the service provider programs. In addition, the service provider SMS process should be used to evaluate possible risk posed by operational changes resulting from RST proposed corrective actions.
- 3.2.4 The RST's meeting schedule depends on the situation and environment of the aerodrome. For example, if major works are proposed, or runway hazards and incidents are increasing, then the RST may need to meet more frequently. However, if operations are stable, with few hazards identified, then the meetings may be less frequent.

3.2.5 The RST is built on the principles of a formal Hazard Identification and Risk Management (HIRM) process, in accordance with ICAO Annex 19 and ICAO Doc 9859 — Safety Management Manual (SMM). The RST should be able to capture the HIRM results from its members, as most of them will have their own SMS's with differing HIRM processes.

3.2.6 The RST should cover a wide range of issues related to runway safety, including but not limited to, the following ICAO occurrence categories:

- a) Abnormal runway contact;
- b) Bird strike;
- c) Ground collision;
- d) Ground handling;
- e) Runway excursion;
- f) Runway incursion;
- g) Loss of control on ground;
- h) Collision with obstacle(s);
- i) Undershoot / overshoot, aerodrome
- j) Use of the wrong runway (runway confusion)
- k) High Speed Rejected Take-Off
- l) Wildlife Event
- m) Damage from Foreign Object Debris (FOD)

3.3 Regulator Participation in RST Meetings

The RST is considered an activity of the SMS of the aerodrome operator, which coordinates safety issues from all the users of that aerodrome. Although their participation is not required, ICAO encourages members of the regulatory authority to attend RST meetings to advise on regulatory matters, participate in the information sharing activities, understand the current hazards and risks associated with local operations, and interface with other government agencies (e.g. land use authorities) on behalf of the RST when appropriate.

3.4 Objectives and Terms of Reference

To facilitate effective decision-making, organizations seeking to establish an RST should agree to a set of procedural rules governing the actions of their representatives. Once formally documented and accepted, these rules will be referred to as the “Terms of Reference” (ToR) of the RST.

Suggested ToRs for the RST include:

- a) Objectives, scope of oversight, and expected frequency of RST meetings
- b) Membership selection processes
- c) Roles and responsibilities of individual RST members
- d) Processes and formal agreements governing sharing of safety data, safety reports, and safety information as well as the protection of the sources of information shared within the RST (protection from inappropriate use and protection against disclosure)
- e) Consultation, decision-making and conflict resolution processes

- f) Regularly review the airfield to ensure its adequacy and compliance with regulations
- g) Ensure that the recommendations contained in the ICAO Doc 9870 - Manual on the Prevention of Runway Incursions are implemented
- h) Documentation and reporting requirements
- i) Monitor runway incidents by type, severity, and frequency of occurrence
- j) Identify risk factors and local issues, particular locations where risk exist (e.g., hot spots), and problems in daily operations and suggest improvements
- k) Solicit assistance by safety experts from within the industry
- l) Contribute to active development of solutions to these issues
- m) Ensure that the best possible solution is implemented
- n) Learn lessons from other incidents and consider the outcome of other investigation reports
- o) Disseminate information on developed solutions to stakeholders
- p) Initiate a comprehensive safety-awareness campaign to ensure that all stakeholders' staffs are aware of safety issues, such as producing and distributing local hot spot maps or other guidance material.

3.5 Generic Terms of Reference for the Team

3.5.1 The local runway safety team will 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 to establish local hot spots or problem areas at the aerodrome;
- c) Working as a combined team to better understand the operating difficulties of those working in other areas, and suggest areas for improvement;
- d) Ensuring the recommendations contained in the guidance material for Preventing Runway Incursions have been implemented;
- e) Identifying any local problem areas and suggest improvements;
- f) Conducting a runway safety awareness campaign, that focuses on local issues, for example by producing and distributing local hot spot maps or other guidance material as considered necessary, and
- g) Regularly reviewing the airfield to ensure adequacy and compliance with the Civil Aviation (Aerodromes Design and Operation) Regulations.

3.6 Continuous Improvement

All team members will monitor the RST activities for areas in need of improvement and/or failure to achieving the conditions set forth in the ToR. Additionally, the chairperson will schedule the following activities:

- a) Internal reviews

At least once every six months, the team will allocate time during a regularly scheduled meeting to discuss each item on the checklist found in Section 5. Their

responses will be recorded and maintained as part of the safety library for at least two years.

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b) External reviews

At least once per calendar year, the RST documentation should be audited and at least one meeting observed by a member of the regulatory body or an agreed third-party. The results of this appraisal will be recorded and maintained as part of the safety library for a period described in the SMS of the aerodrome operator.

3.7 RST Organizational Structure

The organizational setup required for an RST depends on the number of participating members, their interaction and cooperation capabilities and any other local requirements. In any case, the initiator would normally be the aerodrome operator.

This section provides basic concepts of leadership and administration sharing in order to assist RST as necessary. It may vary depending on the size and setup of each team.

Irrespective of the final RST set up, the team will require the designation of leadership and administration. These tasks may be carried out by one or more members of the RST, e.g. one Chairperson and one Rapporteur.

3.8 The RST Chairperson

The Chairperson serves as the coordinator and spokesperson for the team. The nomination and role of the Chairperson can, for example, be organized on a rotational basis amongst all RST members. The roles and responsibilities of the nominated Chairperson may also include a variety of administrative and/or organizational aspects, such as:

a) Meeting planning

The Chairperson schedules the meetings and arranges the venue. He or she gathers input from the members in the weeks prior to the meeting and distributes an agenda one week prior to the meeting date. Guidance on meeting planning is included in Appendix A.

b) Meeting facilitation

The Chairperson ensures the meetings are conducted in a collaborative manner and in accordance with the ToR processes. He or she constantly strives to enhance the programme by regularly engaging in continuous improvement activities.

c) Maintaining the safety library

The Chairperson ensures the actions of the RST are properly documented and maintained in the RST safety library.

d) Coordinating with external agencies

The Chairperson serves as the point of contact with external agencies and ensures all RST activities are properly communicated to applicable agencies/organizations.

3.9 Role of RST members

a) Meeting planning

RST members will submit items for discussion at the next scheduled meeting as soon as possible, but not later than the date requested by the Chairperson. Each member presenting during the meeting should prepare briefing material and invite subject matter experts as necessary to provide the other members with a clear understanding of the issue they wish to discuss. The members should tour the airport just prior to the meeting to familiarize themselves with the current situation and identify potential safety hazards.

***Note** — A tour of the airport during different times of the day and varying environmental conditions should be considered to allow identification of hazards specific to certain light and adverse weather conditions. The tour is for the identification of safety issues only and should not be used by any person external to the RST nor cause disruption to current operations.*

b) Meeting participation

RST members will openly share information and strive to achieve consensus during decision-making activities. They will constantly strive to enhance the programme by engaging in continuous improvement activities.

c) Contributing to the safety library

RST members should contribute safety data & analysis, reports, and information from the safety management systems or other safety relevant sources of their participating organizations to the RST.

Coordinating with participating organizations RST members will communicate the findings and decisions of the RST within their respective organizations and ensure the recommendations are properly addressed.

3.10 Role of the regulator

The RST is considered an activity of the SMS of the aerodrome operator, which coordinates safety issues from all the users of that aerodrome. Although their participation is not required, ICAO encourages members of the regulatory authority to attend RST meetings to advise on regulatory matters, participate in the information sharing activities, understand the current hazards and risks associated with local operations, and interface with other government agencies (e.g., land use authorities) on behalf of the RST when appropriate.

3.11 Hazards and associated consequences

Once the team members are identified, the Chairperson selected, and the ToR and schedule are agreed to, the real work of the RST begins with the hazard identification process. It is anticipated that each member will come to the meeting prepared to brief

on the hazards related to runway safety, as identified through their respective SMS or other aviation safety relevant systems (arising mostly from safety reporting, investigation and audit activities). Hazards identified through the SMS of service providers who may not be participating in person at the meeting should be presented for evaluation. Guidance material on hazard identification is available through ICAO Doc 9859.

In addition to the hazard reporting systems of the member organizations, the RST should also conduct periodic visits to various airport locations (i.e., tower facility, construction areas, taxiway intersections, etc.) and solicit input especially from organizations without formal representation at the meeting. These may include corporate operators, flight schools, industry organizations, ground services and others. By casting a wide net, the RST will develop a deeper understanding of the operational complexity associated with the airport environment and, therefore, be better able to identify hazards and determine operational risks.

As the team discusses the destructive potential of the hazard, it is important to keep in mind that these “consequences” should be framed in realistic operational outcomes, as opposed to extremely remote and unlikely outcomes. A useful technique is to identify the top-level (or generic) hazard, then to list the related specific hazards and associated consequences.

For example,

- a generic hazard category might be **“airport construction.”**
- The specific hazards associated with a construction project at the airport might be **“the presence of construction equipment”** and **“the closure of taxiways.”**

These, in turn, may result in the RST identifying the potential consequences of these specific hazards as **“an aircraft colliding with the construction equipment”** and **“an aircraft taxiing onto a closed taxiway.”** By correctly identifying (and documenting) the hazard and defining the associated consequences in operational terms, the RST is able to assess the safety risk.

Hazardous conditions can sometimes combine, resulting in an even greater severity and/or probability of outcome. For example, the hazards associated with airport construction, coupled with the hazards of low visibility and night operations, may result in a greater risk than just the airport construction hazard alone (in this situation, the probability of the risk would likely be increased).

3.12 Safety Risk Assessment

The reason for conducting safety risk assessments is to provide the RST with a method for appropriately managing the risks of identified hazards, developing effective risk mitigation strategies, and prioritizing their workflow. Given that time and financial resources are limited, the following process allows the RST to efficiently determine which areas require its immediate attention to reduce the runway safety risk to As Low As Reasonably Practicable (ALARP).

The process of runway safety risk assessment and management should be in line with the guidance available in ICAO Doc 9859. Once the hazards have been identified by the RST, the objective is for the airport operator to make a determination of the safety risk severity in the context of the local system, accounting for current defences and mitigations in place at the time. This information should then be used to categorize the safety risk severity using predefined guidance in ICAO Doc 9859.

Based on the event that would be the worst consequence, the next step is to evaluate the relative probability (or likelihood) of that event occurring in the specific operational environment, after taking into account the current defences and risk mitigation strategies in place. The team should consult associated safety and hazard report databases, incident & accident investigation reports, flight data monitoring and analysis, operational audit data and other historical sources to determine the likelihood of the identified consequence occurring.

The last step in the assessment process is to ensure that the resulting level of safety risk is acceptable.

One of the advantages of using the RST to conduct the risk assessment is that all stakeholders have been involved in the risk assessment process, thus ensuring that the worst outcome and appropriate probability have been evaluated.

3.13 Developing Recommendations and Action Plan

Following the safety risk assessment, the RST should develop specific recommendations to reduce the risk, and an action plan to ensure the recommendations are implemented. In doing so, the following concepts should be considered:

a) Prioritization

The RST should ensure their solutions are prioritized according to the “safety risk tolerability” assessment. For example, if they determine that “the operation may continue” with the assessed level of safety risk, their recommendations should reflect a strategy where improvements are implemented as resources become available. Conversely, if they determine “the operation may continue with mitigation,” their recommendations should reflect a strategy requiring immediate action(s) to address the consequences of the hazard. Thus, time frames for completing the actions must be commensurate with the risk levels involved.

b) Control strategies

Safety risk is controlled by addressing either:

- i. the probability of the consequences occurring;
- ii. the severity level of the consequences; or
- iii. both simultaneously.

Key approaches to controlling safety risk include:

- i. Avoidance: The operation or activity is cancelled because the safety risk exceeds the benefit of continuing the operation or activity.

- ii. Reduction: The frequency of the operation or activity is reduced, or action is taken to reduce the severity of the consequences of the risks.
- iii. Segregation: Action is taken to isolate the effects of the consequences of the hazard or build in redundancy to protect against them.

c) Evaluating alternative solutions

During the process, the RST should explore several strategies for controlling safety risks. These strategies should be evaluated against one another to find the most effective and efficient solution using objective and subjective measures. These measures may include criteria such as;

- i. conducting a cost/benefit analysis;
- ii. determining the enforceability of the proposal; and
- iii. assessing the acceptability to the affected stakeholder, and others.

In all cases, however, the RST must conduct a risk assessment of their proposed solution and evaluate any potential hazards created by their strategy.

However, just because a solution is easy to implement, cost effective and acceptable to all stakeholders, it does not mean that it will reduce the risk level. The effectiveness of the strategy in reducing the risk is measured by the residual or remaining risk once the strategy has been activated. A risk assessment should determine if the remaining (residual) risk is acceptable, or if more solutions and mitigations are required.

d) Notification to affected Stakeholder

If the RST determines that either a mitigation strategy is required or part of the operation should be modified or suspended, it should make a formal recommendation to the organization responsible for that part of the operation and include the rationale and risk assessment.

A summary of the entire process should include a master register of the hazards identified, current controls and defences, risk analysis and outcome, additional controls and mitigations, action plan for implementation (owner and timelines), and residual risk. Appendix C contains the RSM Form, which can serve as the tool to accomplish the recording of hazard and associated mitigation processes.

3.14 Record Keeping – Data Sharing

Proper and structured record keeping of observed and identified hazards, safety events and corrective actions allow for trend analysis. The RST should identify a gate keeper who is responsible for the maintenance of the data base and can present reports and analysis upon request of the RST members.

Data exchange and sharing amongst RST members enhances the effectiveness of the RST. RSTs from different airports are encouraged to set a protocol in place that could allow for data sharing across various locations and will support the teams in identifying proper mitigation strategies.

3.15 Identification of action items associated with mitigating runway safety deficiencies

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

3.16 Hot Spots

ICAO Definition of a Hot Spot - *Hot Spot: A location on an aerodrome movement area where there is an increased risk of collision or runway incursion.*

***Note 1.** — The criteria used to establish and chart a hot spot are contained in the PANS-ATM and Annex 4.*

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

Hot spot charts should be produced locally. These charts should be checked regularly for accuracy, revised as needed, distributed locally, and published in the Aeronautical Information Publication (AIP).

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

- a) Awareness campaigns;
- b) Additional visual aids (signs, markings, and lights);
- c) Use of alternative routings;
- d) Construction of new taxiways; and
- e) Mitigating against blind spots in the Aerodrome Control Tower

3.17 Persons or Organizations Completing the Tasks

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

3.18 Effectiveness of Activities Associated with Completing the Task

Periodically assess the effectiveness of implemented and or completed action items. 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 the action item.

3.19 Runway incursion prevention awareness material

Awareness material can be used as a successful tool for reducing risk of runway incursions. These materials can include newsletters, posters, stickers and other educational information.

3.20 Recommendations for the prevention of runway incursions and communications enhancement

The following recommendations are the result of a systemic analysis of many runway incursions. The purpose was to identify causes and contributory factors, both as active and latent failures, which led to the incidents taking place. These recommendations will enhance the safety of runway operations by the consistent and uniform application of existing ICAO provisions leading to predictability and greater situational awareness.

- a) Use the full aircraft or vehicle call signs for all communications associated with runway operations.
- b) Use standard phraseologies in all communication associated with runway operations.
- c) Periodically verify the use of standard phraseologies by pilots, drivers and air traffic controllers in all communication associated with runway operations.
- d) Use the ICAO *Procedures for Air Navigation Services — Air Traffic Management* (PANS ATM, Doc 4444) read-back procedure, to include communication with vehicles operating on the manoeuvrings area.
- e) Conduct all communications associated with runway operations in accordance with ICAO air-ground radiotelephony communications language requirements (Annex 10 — *Aeronautical Telecommunications*, Volume II, Chapter 5 and Annex 1 — *Personnel Licensing*, Chapter 1 refer).
Note: The use of standard aviation English at International aerodromes helps provide situation awareness of everyone listening on the frequency.
- f) Conduct all communications associated with the operation of each runway (vehicles, crossing aircraft etc.) on the same frequency as utilised for the take-off and landing of aircraft.
- g) Use short and simple messages in ATM communications.

See Appendix A for more detailed guidance on communication best practices based upon the Civil Aviation (Aerodromes Design and Operations Regulations).

3.21 Recommendations to Aircraft Operators

- a) Thoroughly train pilots on Aerodrome signage, markings, and lighting.
- b) Include in the flight deck procedures, a requirement to obtain an explicit clearance to cross any runway. This includes runways not in use.
- c) Promote best practices for pilots planning of ground operations.
- d) Adopt the sterile flight deck concept while taxiing. Information on this is contained in Appendix B.

3.22 Recommendations to Pilots

- a) Pilots should not accept an ATM clearance which would otherwise require them to enter or cross a runway from an obliquely angled taxiway.
- b) If lined up on the runway and held more than 90 seconds beyond anticipated departure time, pilots should contact ATM and advise that they are holding on the runway.
- c) 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.

- d) 3.18.4 Pilots should turn on strobe lights when crossing a runway.

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

- e) If there is any doubt, when receiving a clearance or instruction, clarification should be immediately requested from ATM before the clearance or instruction is enacted.
- f) If there is any doubt as to exact position on the surface of an aerodrome, pilots should contact ATM and follow the associated ICAO procedure (PANS ATM, Doc 4444).
- g) Pilots should be “Head up” for a continuous watch during aerodrome surface operations.

See Appendix B for more detailed guidance on Flight Crew Best Practices including the sterile flight deck concept.

3.23 Recommendations for air Traffic Services Providers

- a) Implement safety management systems in accordance with ICAO SARPs.
- b) Air traffic controllers should always use a clear and unambiguous method on the operating console to indicate that a runway is temporarily obstructed.
- c) ATM should whenever practically give ATM en-route clearance prior to taxi.
- d) Ensure that ATM procedures contain a requirement to issue an explicit clearance including the runway designator when authorising a runway crossing or to hold short of any runway. This includes runways not in use.
- e) Ensure that ATM procedures contain a requirement to include the runway designator when issuing an instruction to hold short of any runway.
- f) Develop and utilise standard taxi routes to minimise the potential for pilot confusion.
- g) Where applicable use progressive taxi instructions to reduce pilot workload and the potential for confusion. Progressive taxi instructions must not infer a clearance to cross a runway.
- h) Assess existing visibility restrictions from the control tower which have a potential impact on the ability to see the runway and clearly identify any such areas on a hot spot map.
- i) Environmental constraints should not compromise safety e.g. regular, multiple changes to runway configuration.

- j) Ensure that runway safety issues are included in training and briefings for ATM staff.
- k) Identify any hazards and evaluate any risks of runway capacity enhancing procedures (intersection departures, multiple line up, conditional clearances etc.) when used either individually or in combination. If necessary, develop appropriate mitigation strategies.
- l) Do not issue line up clearance to an aircraft if this aircraft will be required to hold on the runway for more than 90 seconds beyond the time it would normally be expected to depart.
- m) When conditional clearances are used, specific training should be provided to ensure that they are used strictly according to ICAO SARPs.
- n) When using multiple or intersection departures, do not use oblique or angled taxiways that limit the ability of the flight crew to see the landing runway threshold or final approach area.
- o) Controllers should be “Head up” for a continuous watch on aerodrome operations.

See Appendix C for more detailed guidance on Air Traffic Control Best Practices.

3.24 Recommendations for Aerodrome Operators and Vehicle Drivers

- a) An important factor in preventing runway incursions is to limit the physical possibilities 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, the simplicity and logic of taxi/runway lay-out 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 aerodrome infrastructure.
- b) Implement Safety Management System in accordance with provisions of the Civil Aviation (Aerodromes Design and Operations) Regulations, as amended and then ensure a continued focus on runway safety.
- c) Confirm the implementation of the Civil Aviation (Aerodromes Design and Operations) Regulations, as amended, in order to implement maintenance programmes relating to runway operations e.g. markings, lighting, and signage. Ensure that signs and markings are maintained and clearly visible, adequate and unambiguous in all operating conditions.
- d) During construction or maintenance ensure that information about temporary work areas is adequately disseminated and that temporary signs and markings are clearly visible, adequate and unambiguous in all operating conditions in compliance with the Civil Aviation (Aerodromes Design and Operations) Regulations.
- e) Introduce a formal driver training and assessment programme in accordance with the Civil Aviation (Aerodromes Design and Operations) Regulations, as amended and Driver Training Guidelines contained in Appendix D, or where

already in place review these guidelines to be commensurate with the operational complexity at an aerodrome.

- f) Introduce formal communications training and assessment for drivers and other personnel who operate on or near the runway.
- g) Name taxiways in accordance with the Civil Aviation (Aerodromes Design and Operations) Regulations.
- h) If there is any doubt in the mind of a vehicle driver when receiving a clearance or instruction, clarification should be immediately requested from ATM before the clearance or instruction is enacted.
- i) Vehicle drivers should immediately contact ATM, when uncertain of their exact position on an aerodrome; if the driver realizes that is on the runway he/she must immediately vacate.
- j) Vehicle driver should be “Head up” for a continuous watch during aerodrome operations.

See Appendix D for more detailed guidance on Airside Vehicle Driver Best Practices including communication training for drivers.

3.25 Recommendation on procedures for operations in unfavorable visibility conditions

The procedures to be used during operations under poor visibility caused by unfavourable weather conditions vary with each aerodrome and should consider local conditions as prescribed in the Aerodrome Manual. However, the following basic factors will need to be considered:

- a) All motor vehicle drivers and other personnel authorized to operate on the movement area should be adequately trained in the procedures to follow and should be aware of the additional responsibilities placed upon them during these periods;
- b) The point at which the use of the procedures guiding operations under unfavourable conditions must be well defined;
- c) A record should be maintained by ATS of persons and vehicles on the manoeuvring area;
- d) All non-essential vehicles and personnel, e.g. works contractors and maintenance parties must be withdrawn from the manoeuvring area;
- e) Essential vehicles permitted to enter the manoeuvring area must be kept to a minimum and must be in RTF communication with ATC;
- f) Where the possibility of inadvertent entry onto the manoeuvring area exists;
 -
 - i. entry points should be manned where closure of runway is impractical, e.g. between aircraft maintenance areas and manoeuvring areas;

- ii. If an opening is too wide for visual surveillance, then it should be fitted with intruder detection equipment; and
 - iii. those areas with intensive vehicular movement adjacent to the manoeuvring area and with no traffic control should be regularly patrolled;
- g) All unguarded gates/entrances to the manoeuvring area should be kept locked and inspected at frequent intervals;
- h) There should be adequate mechanism for alerting airlines and other organizations with movement area access of the introduction of the unfavourable operating conditions and the procedures put in place. This is particularly important where companies exercise control over their own apron areas and maintenance facilities adjacent to the manoeuvring area;
- i) The aerodrome operator must develop appropriate emergency procedures for operation under these conditions;
- j) The aerodrome Operator should have in place procedures and facilities that ensure continuous update of prevailing conditions necessitating the operations under unfavourable weather conditions.

See the Civil Aviation (Aerodromes Design and Operations Regulations, as amended, for more details on the requirements relating to low or unfavorable visibility operations.

3.26 General and Regulatory Recommendations

- a) Authority/regulators focus on runway incursion risk reduction in their oversight activities.
- b) At each aerodrome, a runway safety team should be established and maintained in accordance with the terms of reference.
- c) 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.
- d) All infrastructure and procedures relating to runway operations should follow ICAO SARPs. Where differences occur, appropriate publication in the AIP and notification to ICAO should be undertaken.

- e) Aerodromes should be certified/licensed according to the Civil Aviation (Certification, Licensing and Registration of Aerodromes) Regulations, as amended.
- f) Joint cross training and familiarisation should be provided to pilots, air traffic controllers and vehicle drivers, to increase 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 familiarisation of signs, markings and aerodrome layout.

- g) The best practices for regulator and air navigation service providers to consider when implementing strategies for preventing runway incursions by air traffic control are contained in Appendix C.

3.27 Recommendations Relating to Incident Reporting and Investigation

- a) The operator will ensure all runway incursions are reported and investigated in accordance with the Civil Aviation (Aerodromes Design and Operation) Regulations, as amended in sufficient detail to identify specific causal and contributory factors (Appendices F and G).
- b) The operator will enhance learning, share related runway safety data with other aviation safety organizations both nationally and internationally.

3.28 Recommendations Related to Aeronautical Information Services

The aerodrome operator shall report all important aeronautical information to the AIS in compliance with the Civil Aviation (Aerodromes Design and Operations) Regulations, as amended, while adhering to the following aspects:

- a) Time critical aerodrome information which may affect operations on or near the runway should be provided to pilots in ‘real-time’ using radiotelephony communication.
- b) The collection, provision and dissemination of aeronautical information should be in accordance with AIS established procedures.
- c) The providers of aeronautical databases and charts should establish a process with AIS with the objective of ensuring the accuracy, timeliness, and integrity of the data.
- d) The operator will ensure a process is put in place to allow users to provide feedback on the accuracy of aeronautical information.

4.0 INCIDENT REPORTING AND DATA COLLECTION

4.1 Objective

The objective of this chapter is to enable a standardized approach for reporting and analyzing information on runway incursions. This approach will support analysis of incursions using the severity classification scheme. Global use will enable States to collect and share data to continually improve the safety of runway operations. Regulatory requirements for incident reporting are described in the Civil Aviation (Aerodromes Design and Operations) Regulations, as amended.

When identifying the causes and contributory factors of runway incursions, the operator must collect and record specific information on each occurrence. This information is best collected in a “just culture” environment where reporting is promoted. This allows the possibility of learning 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 involved in such incidents.

An international exchange of information has the potential to act as an effective contribution to global aviation safety in two ways:

- a) Each operator can contribute to a full understanding of how individual errors evolve into runway incursions and potential collisions, leading to the development and implementation of effective mitigating measures.
- b) Each operator can learn from the experiences of other states so that the same mistakes do not perpetuate. The above also applies to inter station networking.

4.2 Just Culture and Systemic Issues

“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. This just culture philosophy is designed to counter the strong natural inclination to blame individuals for errors that contribute to runway incursions.

- a) A key objective of the just culture perspective is to provide fair treatment for people, applying sanctions only where errors could be considered intentional, reckless or negligent.
- b) Even the most conscientious and well-trained pilot, airside vehicle driver and air traffic controller is capable of being involved in 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.
- c) 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.

- d) The way in which incidents are analysed 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.
- e) As a principle 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 occurrence of a controller forgetting about an aircraft holding on the runway in anticipation for takeoff, 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.
- 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, relevant environmental conditions, etc.) and to the latent conditions that originate from deep within the organization (e.g. complex aerodrome layout, inadequate signs and markings, high workload etc.).
- 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, points to possible mitigating measures.

4.3 A Standard Approach to Runway Incursion Incident Reporting and Data Collection

- a) Annex 13 — Aircraft Accident and Incident Investigation requires States to establish a mandatory incident reporting system to facilitate collection of information on actual or potential safety deficiencies.
- b) Annex 6 — Operation of Aircraft, Annex 11 — Air Traffic Services, Annex 14 — Aerodromes, require that States establish safety programmes in order to achieve an acceptable level of safety in the provision of services.
 - i. Use of standard definitions, reporting formats, and error taxonomy will help to facilitate data sharing among States.
 - ii. The larger the data pool the more robust the analysis of common causal factors and thus a better understanding of the nature of the problem.
- c) Procedures for Air Navigation Services — Air Traffic Management (PANS-ATM, Doc 4444), contains procedures for 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.
- d) The initial runway incursion notification form (see Appendix F) requires inclusion of data to describe the event and to classify its severity.

- e) The runway incursion causal factor identification form (see Appendix G) contains the how, what and why the event took place and is completed once the detail investigation into the event is complete.

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

Pooling data requires that all participating organisations adopt a common, reliable, and robust method of data collection. Furthermore, methods used to analyse the results should be harmonised to ensure a comparability of results from the data analysis.

NOTE: We must all remember that the quality of the investigations has a direct impact on the assessment of risk of collision, severity of the outcome, and identification of causal and contributory factors.

4.4 Severity Classification for Runway Incursions

The objective of the runway incursion severity classification exercise is to produce and record the assessment of each runway incursion. This is a critical component of measuring risk, where risk is a function of the severity of the outcome and the probability of recurrence.

- a) 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.
- b) Severity classification of runway incursions should be assessed as soon as possible after the incident notification. A reassessment of the final outcome may be applied at the end of the investigation process.
- c) For the purpose of national or even global harmonization and effective data sharing, when classifying the severity of runway incursions, the following severity classification scheme should be applied:

Accident	Refer to Civil Aviation (Aerodromes Design and Operations) Regulations
A	A serious incident in which a collision was narrowly avoided.
B	An incident in which separation decreases and there is a 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	Incident that meets the definition of runway incursion such as incorrect presence of a single vehicle/person/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 inconclusive or conflicting evidence precludes severity assessment.

4.5 Factors that Influence Runway Incursion Severity

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

a) Proximity of aircraft and/or vehicle

This distance is usually approximated by the controller or from the aerodrome diagram.

- If the aircraft flew directly over the other 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 of collision 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 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, swerve, rejected takeoff, early rotation on takeoff, and go-around. The more severe the manoeuvre, the higher the contribution to the severity rating. For example, encounters involving a rejected takeoff in which

the distance rolled was 300 meters would be more severe than those in which the distance rolled was less than 30 meters.

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 had 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 would be more severe than one that involved a light aircraft initiating a go-around on a one-mile final.

e) Environmental conditions such as weather, visibility and surface condition

- i. 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.
- ii. Similarly, conditions that degrade the aircraft or vehicle stopping performance, such as wet runways should also be considered.

4.6 Factors that affect system performance

Factors that affect system performance, such as communication failures (e.g. “open mike”), communication errors (e.g. the controller’s failure to correct an error in the pilot’s read-back) also contribute to the severity of the incident.

5.0 RUNWAY SAFETY GO-TEAMS

5.1 Introduction to the Methodology

The objective of a RS Go-Team is to assist a State and airport in establishing an RST, supporting the implementation stage by providing technical assistance, including training, assessments and gap analysis, expert advice and guidance based on best practices.

Runway Safety is a global safety priority. The use of coordinated and regionally deployed RS Go-Teams allows the use of existing expertise to foster the establishment and operation of RSTs.

The work of the RST, once established, will be supported by the ICAO Regional Office and the associated Regional Aviation Safety Group (RASG), which support implementation efforts related to the regional safety priorities and targets and the ICAO Global Aviation Safety Plan.

A RS Go-Team will be established based on a recommendation from the RASG, proposal by ICAO, or a request received from a State or airport to ICAO. Runway Safety Programme partner organizations will be informed of RS Go-Team plans and invited to participate.

When ICAO receives a request for a RS Go-Team from an airport, it will coordinate with ACI, particularly in relation to the Airport Excellence (APEX) in Safety programme to ensure the necessary coordination to avoid any potential duplication of activities. The ACI APEX in Safety programme is designed to help airports identify and mitigate aviation safety vulnerabilities through peer review missions, education, mentoring and best practice guidance.

These peer review missions involve 1 – 2 weeks on site depending on the complexity of the airport being visited. The visit team, which usually includes an ICAO member, works with the host airport to cover airside operations on the runways, taxiways and

aprons, infrastructure including lights, markings, signage, Rescue and Fire Fighting as well as reviewing documentation and systems such as Safety Management. The output of the APEX review is a report containing recommendations, mitigation strategies and relationships with industry resources that can be called upon to provide assistance.

It is important to note that while the APEX team will address Runway Safety and Runway Safety teams, the team will focus on ensuring that a team is in place following ICAO and ACI best practice, or if not, create the framework to facilitate its creation to improve operational safety.

The ICAO Runway Safety Programme Go- Team missions are built upon a complementary model, however, the focus is primarily limited in scope to Runway Safety, involving 4 days on site depending on the existence and maturity of a Runway Safety Team at, and needs of, the airport being visited. ICAO and ACI will coordinate on the complementary programmes to ensure there is synergy and no duplication in activities between the two programmes at any airport being considered for both an APEX safety review and RS Go-Team.

6.0 RS GO-TEAM MISSION PHASES

The RS Go-Team mission can be divided into the following phases:

a) Preparation

The coordination of the Go-Team preparation will be led by the ICAO Regional Office.

Phase I – Selection of candidate State and airport (at least twelve weeks prior to the mission)

Key actions and considerations:

- Criteria for the selection: State or airport request; USOAP audit results (e.g., non- existence of an RST); outcome from RASG activities (e.g., regional concerns based on data and reports, identified runway safety hazards/risks; high number of runway safety incidents/accidents; traffic volume, aerodrome layout complexity, proposal by a safety stakeholder/partner, etc.
- Go-Team Pre-planning: Details of the eventual Go-Team members and mission to be communicated well in advance to interested parties: airport, State and partners, meetings, mission date, time, and location

Phase II – Data collection

Data to be collected and assessed before a mission is arranged:

- Identification of potential stakeholders (local and international expertise available). See Appendix D - List of national/local agencies at an airport expected to participate in an RS Go-Team mission

- Existing safety data and information on existing local runway safety initiatives and related implementation plans
- Capture available airport-specific data (surface events, LOAs/SOPs, training programmers, etc.)
- Request detailed information on hazards and risks, knowledge and experience on the airport, hot spots (request ATC Officers to update a list of every instance of wrong turns, requests for amplified taxi instructions, vehicles in the wrong place, etc.)
- Communications with relevant partners
- Send the received information and data to the Go-Team members as far in advance as possible.

Phase III – Coordination (at least three weeks before the mission)

Coordination with State and RS Go-Team members, including logistics. Mechanisms for an effective and efficient RS Go-Team mission include:

- Identification of focal points of contact among partners
- Teleconferences
- RS Go-Team Agreement (see Attachment A)
- Proposed dates
- Team logistics: tickets, hotels, meeting rooms, transportation, visas, etc.
- Roles and responsibilities
- Expected outcomes: Report, detailed implementation plan, follow-up
- PowerPoint presentations should be previously coordinated to avoid duplication of information and ensure focus on the RST's activities and expected outcomes. One presentation per topic, which can combine particular approaches from different organizations.
- Agree on agenda for the RS Go-Team
- Schedule and coordinate airport visit

At least one week prior to the RS Go-Team mission:

- Consolidate updates and information received from the team members and industry stakeholders.
- Distribute the final agenda and supporting documents to the team and the interested stakeholders (Airport, State, etc.)

b) On-site activities (suggested: 4 days)

The Go-Team will focus on establishing an effective RST, ensuring that its members clearly understand what they should do and how to do it, based on their roles and responsibilities. Activities will be, to the maximum extent possible, in accordance with the procedures detailed in the ICAO RST Handbook and references in the ICAO Runway Safety i-Kit.

Phase IV – RS Go-Team deployment

- Two days' preparation briefing (knowledge transfer and sharing of best practices): Day 1- RS Go-Team on-site coordination and agreement; training, detailed data, hazard identification and risk mitigation strategies, action plan, reporting, sharing and use of safety information, stakeholders; Day 2- RST Terms of reference, which will include accountability, roles, duties and responsibilities.
- Two-day airport visits and One-day debriefing (following local RST framework and proceedings): Day 1- Go-Team, visit to the airport and relevant facilities, installations and equipment; Day 2-Go-Team review of airport operations and procedures, identification of hazards, reporting system and planned risk assessment; Day 3- Agreement on actions to be taken, responsibilities, de-briefing.

Phase V – Report, Action Plan and Recommendations (responsible: local RST)

Prepare a technical report, including observations and recommended mitigation actions, as well as other recommendations as may be required:

- Contents
- Hazards and risk mitigation proposals
- Areas of improvement and recommendations
- Expected outcomes
- Identified Hot Spots
- Recommendations and plan for action, including:
 - prioritized actions and associated timelines
 - Timeframe for the resolution of identified safety issues
 - Resource planning
 - Funds
 - Responsibilities
 - Potential barriers for the establishment and proper functioning of the RST
 - Stakeholder Management Plan

c) Implementation and follow-up

Phase VI – Implementation (responsible: RST)

- RST meetings (frequency, format, agenda, chairmanship, quorum, etc.)
- Resolution of identified safety issues

Phase VII – Follow-up

Continuous monitoring of progress will be done by the ICAO Regional Office within the RASG framework as reported by the State, considering:

- Action plan
- Baseline measurement: comparison between pre- and post-implementation of safety improvements

- Annual performance measurement of the operational benefits achieved to be included in the Regional Annual Safety Report
- Possible future Follow-up Go-Team missions

7.0 APPENDICES

APPENDIX A: COMMUNICATIONS BEST PRACTICES

- 1.1 From many investigation reports and surveys regarding runway safety occurrences, it is apparent that communications issues are frequently a causal or contributory factor.
- 1.2 The demanding environments associated with runway operations require that all participants accurately receive, understand, and correctly read back all clearances and instructions being transmitted. While read back requirements are 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/instruction, or part of a clearance/instruction, flight crews should request clarification from ATM and subsequently read back all items of the clearance/instruction to ensure understanding.
- 1.4 At times, the volume, speed of delivery, and complexity of RTF instructions can impose difficulty on controllers, vehicle drivers and/or pilots, especially when the language in use is not the native language of the participants. Transient crew not speaking in their native language are often susceptible to misunderstandings generated by use of colloquialisms, therefore the use of ICAO standard phraseology and phonetics are critical to enhancing the safety of operations.
- 1.5 Use of ICAO air-ground radiotelephony communication language requirements (language normally used by the station on the ground or the English language) * will facilitate the establishment and maintenance of situational awareness for all participants associated with runway operations. To be effective, a limited set of phraseologies (15 – 20) could be identified for vehicle drivers. ICAO Annex 1 contains a recommended practice concerning minimum requirements for language proficiency for pilots and ATS personnel.

* ICAO air-ground radiotelephony communications language requirements are shown in Annex 10— *Aeronautical Telecommunications*, Volume II, Chapter 5 and Annex 1 — *Personnel Licensing*, Chapter 1 and its appendix.
- 1.6 To maintain high levels of situational awareness it is also recommended that communications for all operations on a runway (landing, departing, 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 Use of established ICAO standard phraseologies for radiotelephony communication between aircraft and ground stations is essential to avoid misunderstanding the intent of the messages, and to reduce the time required for communication. ICAO phraseology should be used in all situations for

which it has been specified. When standardised phraseology for a particular situation has not been specified, plain language is used.

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

Example Phraseologies example phraseologies shown below are taken from the ICAO provisions.

- a) For a complete listing of ATM phraseologies refer to PANS-ATM (Doc 4444), Chapter 12 and Annex 10, Volume II.
- b) Annex 10, Volume II, “In all situations for which standard radio telephony phraseology is specified, it shall be used.”
- c) These phraseologies apply to air traffic controllers, pilots, and when applicable, to vehicle drivers.

Note 1. *Words in parentheses () indicate that specific information, such as a level, a place or a time, etc., 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.*

Note 2. *The detailed phrases listed below do not form the complete phrases to be used, nor do they represent the total number listed in the PANS-ATM (Doc 4444). They refer to those elements considered crucial to runway safety aspects.*

1) TAXI PROCEDURES for departure

ATM: (call sign) TAXI TO HOLDING POINT [number] [RUNWAY (number)];

Or ... where detailed taxi instructions are required.

ATM: (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)];

ATM: (call sign) TAXI VIA RUNWAY (number);

PILOT: (call sign) REQUEST BACKTRACK;

ATM: (call sign) BACKTRACK APPROVED;

ATM: (call sign) BACKTRACK RUNWAY (number);

Other general instructions

ATM: (call sign) FOLLOW (description of other aircraft or vehicle);

ATM: (call sign) VACATE RUNWAY;

PILOT/DRIVER: RUNWAY VACATED (*call sign*)

2) HOLDING INSTRUCTIONS FROM ATM

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

(*call sign*) HOLD POSITION;

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

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

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

3) TO CROSS A RUNWAY

PILOT/DRIVER:

(*call sign*) REQUEST CROSS RUNWAY (*number*);

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

ATM: (*call sign*) CROSS RUNWAY (*number*) [REPORT VACATED];

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

ATM: (*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 — *The pilot will, when requested, report “RUNWAY VACATED” only when the entire aircraft is beyond the relevant runway-holding position.*

4) PREPARATION FOR TAKE-OFF

– clearance to enter runway and await take-off clearance.

ATM: (*call sign*) LINE UP [AND WAIT];

ATM: (*call sign*) LINE UP RUNWAY (*number - in multiple runway / intersection*)

departures);

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

5) CONDITIONAL CLEARANCES

a) Conditional clearances must consist of the condition before the line up

instruction, and an acknowledgement of the correct (or otherwise) read back is required as part of the correct procedure e.g.: ATM: ATC 601, BEHIND DC9 ON SHORT FINAL, LINE UP BEHIND.

b) The acknowledgement of a conditional clearance must contain the condition in the Read back. e.g.:

Pilot: BEHIND LANDING DC9 ON SHORT FINAL, LINING UP BEHIND ATC601.

ATM: ATC601 [THAT IS] CORRECT.

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. Clearly identify the aircraft or vehicle that is the subject of a conditional clearance. Always read back the identification in full.

6) TAKE-OFF CLEARANCE

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

Note: [REPORT AIRBORNE] Applicable for Low Visibility operations;

a) When take-off clearance has not been complied with:

ATM: (*call sign*) TAKE OFF IMMEDIATELY OR VACATE RUNWAY
[(*instructions*)];

ATM: (*call sign*) TAKE OFF IMMEDIATELY OR HOLD SHORT OF
RUNWAY;

Or ...to cancel a take-off clearance

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

PILOT: HOLDING (*call sign*);

Or ...to stop a take-off after an aircraft has commenced take-off roll

ATM: (*call sign*) STOP IMMEDIATELY [(*repeat aircraft call sign*) STOP

IMMEDIATELY];

PILOT: STOPPING (*call sign*);

1.9 Aerodrome Control Phraseology – READ BACK

- a) Of equal importance to the usage of correct phraseologies is the need to obtain the required read back, in the order required and accurately.
- b) Listed below are the provisions provided in the relevant ICAO documents pertaining to this safety critical element of runway operations, together with the paragraph number in the ICAO document.

1.10 Annex 11 — Air Traffic Services

“Annex 11 *Read-back of clearances and safety-related information*: The flight crew shall read back to the air traffic controller safety-related parts of ATM clearances and instructions which are transmitted by voice.”

1.11 Read Back requirements

The Air Traffic Controller is responsible for checking the completeness and accuracy of the read back. An aircraft must include its call sign in the read back, and a failure to do this shall be challenged by the controller. The following items shall always be read back:

- a) ATM route clearances;
- b) Clearances and instructions to enter, land on, take off on, hold short of, cross and backtrack on any runway; and Runway in use, altimeter settings, SSR codes, level instructions, heading, and speed instructions whether issued by the controller or contained in ATIS broadcast, transition levels.

“Annex 11: 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.”

“Annex 11: The controller shall listen to the read-back 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 read-back.”

1.12 Communication techniques – general

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

1.13 Issue of en-route clearance

- a) Whenever possible an en-route clearance should be passed to an aircraft before start of taxi. If this is not possible, controllers should try and avoid passing the clearance to a pilot engaged in complicated taxiing manoeuvres near the runway due to the possibility of distraction.
- b) An ATM 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 takeoff clearance. At other times the words “DEPARTURE” or “AIRBORNE” are used.

1.14 Taxi instructions

- a) 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 ATM.
- b) When a taxi clearance contains a taxi limit beyond a runway, it shall contain an explicit clearance to cross that runway, or an instruction to hold short, even if the runway is not in use.
- c) Communication with any aircraft using the runway for the purpose of taxiing should be transferred from the ground controller to the aerodrome controller prior to the aircraft entering / crossing a runway.
- d) It is strongly advised, when practicable, to use standard taxi routes.
- e) 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 taxiway 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.

ATM: AFR 375, 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.

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

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

- 1.15 Further guidance on this subject can also be found in Appendix B – ‘Communications Guidance’.

- 1.16 It should be noted that the ICAO phraseology “TAXI TO HOLDING POINT ...” may be misunderstood by some pilots due to the use of non ICAO phraseology within North America, where “POSITION AND HOLD...” is used by ATM when issuing a line up clearance. There have been a number of runway safety occurrences due to this misunderstanding, and the read-backs should be very carefully monitored.

Multiple line-ups on the same runway; Line-up instructions may be issued to more than one aircraft at different points on the same runway, using the ICAO criteria.

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

ATM: KQA123 LINE UP AND WAIT RUNWAY 22 INTERSECTION
BRAVO NUMBER 2 FOR DEPARTURE NUMBER ONE AN AIR
TANZANIA 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

1. AIM OF THIS APPENDIX

The aim of this appendix is to highlight some of the causal or contributory factors that have resulted in runway incursions.

Aircraft operators are invited to review the materials put forward in this document, and where necessary, amend their Standards Operating Procedures with regard to ground operations.

2. CRITICAL PHASE OF FLIGHT

The numbers of ground movements on aerodromes keep on increasing significantly. To provide the needed capacity on the ground, it is necessary to continuously review the layout of the taxiway infrastructure leading to increasingly complex taxiway systems at major aerodromes.

With the evolutionary process of enhancement and change accelerating in recent times, it remains imperative that pilots remain aware of the signage and markings being applied. Every opportunity to familiarise oneself should be taken, and where possible, information critical to safe aerodrome operations, should be shared.

The current generations of aircraft have highly automated and complex systems that have allowed the preparation and programming of the total flight on the ground. This has resulted in flight deck workload peaks shifting to the ground phase of aircraft operations. These evolutions are irreversible and appropriate mitigating measures should be undertaken to prevent runway incursions. Consequently, the taxi 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. Prioritisation of administrative and commercial tasks, such as weight and balance calculations, certain checklist items, Captain’s welcome speeches, etc. prior to leaving the ramp will assist in reducing 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 for taxi operation is essential and should be completed at the gate or prior to starting descent:

- 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. Visualise this information on the charts;
- d) Standard taxi routes are used more often at busy aerodromes. Review the routes you expect to use. If you are not cleared for expected taxi route, you should take adequate time to familiarize yourselves 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 you will encounter between where you are and where you are going;
- f) Plan timing and execution of check-lists, 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

The “before take-off” briefing should be simplified as much as possible. Go through pre- departure check-lists when the aircraft is stationary. Several taxi items can be addressed during the “before start” briefing at the gate. The briefings 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.

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

Memory is “constructive”. That is: we have the tendency to fill in the blanks. Ensure that you follow the clearance or instruction that you actually received and not the one you expected to receive.

Be aware that the expectations established during the pre-taxi or pre-landing planning can be significantly altered with a different and unexpected clearance.

The following additional check list may assist with briefing preparations:

- a) Conduct a briefing for all flight crewmembers;
- b) Become familiar with the aerodrome;
- c) Plan timing and execution of checklists;
- d) Review NOTAM’s;
- e) Flight crew should fully understand all departure briefing items;
- f) Assigned taxi route should be briefed as thoroughly as an instrument approach; and,

- g) The aerodrome diagram should be readily available to all flight crew members.

6. TAXI PROCEDURES

a) Clearance

The receipt of any clearance and the taxi clearance itself requires the complete attention of all flight crew on the flight deck. If necessary, write down taxi-instructions, especially at complex or unfamiliar aerodromes, and cross-check the instructions against the aerodrome chart. Clarify any uncertainties about your clearance or your position on the aerodrome before the start of taxi or after vacating the runway. When not sure of taxi instructions, stop, request clarification from ATM and only continue taxiing when the required taxi routing has been confirmed. In case of doubt: ask.

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

b) Public Address Announcements

Public address welcome announcements by flight deck should be transferred from the taxi phase to a moment before engine start-up or push back. 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 cause the other pilot to be isolated in the flight deck.

These calls and announcements should, if possible, be avoided while taxiing and especially when approaching the active runway.

If it is necessary to leave the ATM frequency, notify other flight crew members. Afterwards, be briefed by the other crew member of what may have been missed.

c) Taxi Best Practices

- (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.
- (2) Cancel check list activity when crossing and entering runways. One flight crew member should maintain full concentration on the runway traffic situation.
- (3) When entering any runway, check for traffic (left and right) using all available surveillance means, e.g. all eyes to be used.
- (4) When cleared to line up and/or when crossing any runway, position the aircraft in a right angle with the runway where possible, in order to better observe other traffic, both arriving and departing.
- (5) Do not rush. The higher the ground speed, the less time available to react, manoeuvres the aircraft and avoids obstacles. High speed also results in

greater distance and time required to bring the aircraft to a complete stop. Time can be an ally and an enemy; use it wisely. Taxi defensively, and be prepared for others mistakes.

- (6) 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 ATM clearance has been received.
- (7) Adopt the “sterile flight deck” concept while taxiing.
 - i. During movement of the aircraft the flight crew must be able to focus on their duties without being distracted by non-flight related matters.
 - ii. Ensure cabin crews are aware of this requirement if it is not a Standard Operating Procedure.
 - iii. The following definition of a ‘Sterile Flight Deck’ is offered as a reference.
 - **Sterile flight deck definition:** Any period of time when the flight crew should not be disturbed, except for matters critical to the safe operation of the aircraft.
 - Explanation: 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.
 - iv. It is generally accepted that the need for a sterile cockpit commences:
 - (1) **Departure:** when the aircraft starts engine(s) and ceases when the aircraft reaches 10 000 feet above the departure aerodrome elevation;
 - (2) **Arrival:** when the aircraft reaches 10 000 feet above the arrival aerodrome elevation until the engine(s) are shut down after landing and;
 - (3) Any other times determined and announced by the flight crew, (e.g. in flight emergency, security alert etc.).
- (8) Use all aircraft lights to help controllers and other pilots to see the aircraft.
- (9) Fixed navigation lights and taxi lights should be on whenever the aircraft is moving. Landing lights should be turned on when cleared for take-off (Note – standard procedures to be inserted).
- (10) Check audio box and volume adjustment whenever a frequency change is made.
- (11) Ensure all flight crew are on the appropriate frequency until all runways have been vacated after landing.
- (12) After landing, vacate the runway as soon as possible, but not by turning onto another runway, unless specifically instructed to do so.
- (13) When the aircraft has vacated the active runway, be prepared to stop to resolve any questions about the ATM clearance or about the aircraft position.
- (14) Anytime there is uncertainty about the location of the aircraft position on the movement/manoeuvring area, STOP the aircraft, advise ATM, and ask for clarification. Take the question out of the flight deck.
- (15) If necessary, request progressive taxi instructions.
- (16) Never stop on a runway unless specifically instructed to do so.
- (17) The following check list may assist with best practice preparations:

- If necessary, write down taxi route;
 - Assign a crew member to progressively follow aircraft position on chart;
 - Follow company SOP's in regard to exterior lighting when taxiing and cleared for take-off – where possible, maximum illumination;
 - Sterile flight deck during taxi;
- (18) Be aware that the visibility required for taxiing may be less than the runway visual range (RVR);
 - (19) Be alert for mandatory signs/markings and runway guard lights;
 - (20) Look for visual aids such as taxiway location information and destination signs;
 - (21) Designate a crew member to look for and report signs / markings and keep track of location against the aerodrome chart;
 - (22) Conduct pre-departure checklists when the aircraft is stationary;
 - (23) Use STANDARD radio phraseology;
 - (24) Receive explicit clearance before crossing any runway;
 - (25) READ-BACK all runway crossing or hold short clearances using correct phraseology;
 - (26) DO NOT be rushed by any party (ATM or company);
 - (27) LISTEN to clearances issued to other aircraft;
 - (28) Before entering or crossing any runway, CHECK FOR TRAFFIC!!
 - (29) No checklist activity crossing any runway;
 - (30) Ensure correct understanding of the ICAO phraseology "Taxi to holding point"; and
 - (31) A common phraseology problem is the fundamental difference between the phraseology "position and hold" (which has the same meaning as the ICAO standard phrase "line up [and wait]") and the standard ICAO phraseology "taxi to holding point" (which means taxi to, and hold at the runway holding point. Listen carefully to the instruction. If unsure – ASK.

d) Language

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

e) Proficiency

- Conducting and comprehending radiotelephony communications requires competence with standard phraseology as well as general proficiency in the language used for communications.
- Use standard phraseology at all times. Strict adherence to standard phraseology avoids miscommunications. See Appendix A.
- Speaking slowly is essential when operating in foreign regions. When the speech rate is slowed, the response may be slower and clearer.

f) Read-Backs

Any clearance requires a read-back. The following Standard is included in ICAO Annex 11: The flight crew shall read back to the air traffic controller safety-related parts of ATM clearances and instructions which are transmitted by voice.

The following items shall always be read back:

- i. ATM route clearances;
- ii. clearances and instructions to enter, land on, take off from, hold short of, cross and backtrack on any runway; and
- iii. 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.

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

Any read-back requires a hear-back. In order to complete this “communication loop”, the read-back must be complete and clear. Read-back the full clearance, including call sign and runway designator. “Roger” is not a read-back.

g) Listen

Listen on the frequency at all times. Try to visualise the other traffic in the vicinity. Know what runways will be encountered between where you are and where you are going. Be particularly attentive to all clearances and instructions issued to traffic involving those runways.

7. OTHER COMMUNICATION BEST PRACTICES

- a) Be extra attentive when other aircraft with similar call signs are on the frequency.
- b) When instructed to follow other traffic, this does not automatically include the clearance to enter or cross a runway. Each aircraft requires a specific clearance to enter or cross any runway. If in doubt, seek clarification.
- c) If you are cleared to “line up and wait”, then only a short delay on the runway should be anticipated. If you find yourself in this position for an extended period, advise about your position and seek clarification.
- d) 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 and land on a runway. Any misunderstanding or disagreement should be cleared up immediately by contacting ATM for clarification.
- e) The use of headsets increases the readability of communications with ATM and within the flight deck.
- f) Ensure the correct setting of the audio panel, especially after any temporary switch in audio sources.
- g) State your position on the aerodrome whenever making initial contact with any ground or aerodrome controller, regardless of whether you have previously stated your position to a different controller.
- h) Adopt the sterile cockpit rule during taxi phase.

8. SITUATIONAL AWARENESS

Situational awareness is about knowing where you are and where you want to go, as well as building the picture of the traffic in the vicinity.

Facts:

- (1) Even during daylight and in good visibility, people get lost.
- (2) Even worse is the situation where you think you know your position, but find yourself elsewhere.
- (3) At times of darkness and low visibility, additional care must be taken to ensure that accuracy in navigation on the ground and the highest degree of situational awareness is undertaken by all members of the flight crew.

The following check list may assist with maintaining situational awareness before starting the approach:

- a) Obtain all needed information;
- b) Brief planned primary runway exit and taxi route;
- c) Eliminate as much distraction as possible;
- d) Have aerodrome diagram available for instant use;
- e) Maintain situational awareness on final approach at night; and
- f) Listen for clearances to other aircraft.

9. VISUAL AIDS

- a) 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 the symbols and signs is therefore necessary. All the visual information that is available should correlate with the actual situation. Gathering visual information and the constant questioning and cross checking of your 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.
- b) Head down situation during taxi should be limited to the minimum amount of time possible.
- c) When a pilot not taxiing the aircraft focuses on the instruments in the flight deck, he/she is not able to monitor the progress of the aircraft. Before undertaking head-down actions advise the other pilot, so that added emphasis can be placed by the navigating pilot on maintaining navigational accuracy and situational awareness.

10. OTHER AIDS

- (1) Use your heading display or compass to confirm the runway or taxiway alignment with the information available from the charts.
- (2) If available, use the ILS centre line guidance system to confirm the correct runway alignment.
- (3) Have a good look out; scan the entire runway and approach in both directions before entering a runway. If in doubt, seek clarification.

11. CONCLUSION

You can help to prevent runway incursions! HOW?

- a) It is essential to adhere strictly to all relevant legislations; ICAO Standards and Recommended Practices, Procedures and guidance material, including phraseologies;
- b) Flight crews need to ensure that they follow the clearance or instructions that are actually received, and not those that the flight crew is expecting to receive;
- c) Good planning of ground operations can decrease the workload during taxi. The flight and its associated risks start during the preparation;
- d) Good situational awareness is the top priority during taxi. All crewmembers should be involved;
- e) Application of “Crew Resource Management” principles during taxi is as important as during other phases of flight;
- f) Even the most professional and experienced people make mistakes. By being defensive and letting the built-in safety nets do their work, a single mistake should not lead to a serious incident or accident; and
- g) Never take anything for granted.

APPENDIX C: AIR TRAFFIC MANAGEMENT BEST PRACTICES

1. AIM OF THIS APPENDIX

The aim of this appendix is to highlight some of the causal or contributory factors that have resulted in runway incursions. It is usually the responsibility of the Air Traffic Management provider to put best practices in place to prevent runway incursions.

The use of standard aviation English at international aerodromes enhances situational awareness of all those listening on the frequency.

2. CLEARANCES

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

An en-route clearance does not authorize the pilot to take off or enter an active runway.

The words “TAKE OFF” shall only be used when an aircraft is cleared for take-off, or when cancelling a take-off clearance.

3. READ-BACK REQUIREMENTS

Read-back requirements have been introduced in the interests of flight safety. The stringency of the read-back requirement is directly related to the possible seriousness of misunderstandings in the transmission and receipt of ATM clearances and instructions. Strict adherence to read-back procedures ensures that the clearance or instruction has been received and understood correctly by the correct aircraft.

The flight crew must read back to the air traffic controller safety-related parts of ATM clearances and instructions.

The air traffic controller is responsible for checking the completeness and accuracy of the read-back.

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

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

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

- d) 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.

An aircraft must include its call sign in the read back, as a failure to do this should be challenged by the controller.

In PANS-ATM (Doc 4444) it is stated *“The controller shall listen to the read-back 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 read-back”*.

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

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 ATM.

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.

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

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. 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.

APPENDIX D: AIRSIDE VEHICLE DRIVING BEST PRACTICES

1. Introduction

It is usually the responsibility of the Aerodrome Operator to have in place a formal training, assessment, and authorisation 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.

The operation of vehicles on the aerodrome have been highlighted as a potentially high-risk activity which demands a number of formal control measures to 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.

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

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 health and safety aspects of operating vehicles, plant and equipment in close proximity to aircraft on movement/maneuvering areas, aprons, stands and airside roads;*
- b) specific training on the vehicle, plant and equipment, e.g. car, tug, high loader, coach;*
- c) where the specific job function requires the driver to operate on the maneuvering area then additional training on the hazards associated with runways and taxiways should be covered; and*
- d) an essential requirement of operating a vehicle on the maneuvering area is the need to communication with the Aerodrome Control Tower. This requires training in the correct use of RTF and standard phraseology.*

The following material describes what should be considered as ‘good practice’ guidance and is applicable to the majority of aerodromes. The material describes a generic framework for the four main areas shown above. It is vital that both theoretical formal training and practical experience cover all four areas. The aim of this guidance is to ensure consistency and a high degree of standardisation in the manner in which a driver obtains an ‘Airside Driving Permit’.

2. Factors associated with development of a framework for an airside vehicle driver training Programme

- 2.1** Issues to be considered when developing programmes and knowledge requirements for the airside driving permit (ADP) as required by Civil Aviation (Aerodromes Design and Operations Regulations are:

- a) *the issuing authority (normally the aerodrome operator), its validity in terms of time, conditions of use, its transferability;*
- b) *ownership of the permit, control and audit of permit issue;*
- c) *local enforcement and driving offence procedures; and,*
- d) *Relationship to State driver licensing system.*

2.2 National Legislation and Regulation

- a) government/national regulations related to general vehicle driving licences;
- b) National/regional/local government requirements; and
- c) National aviation safety authority requirements/guidance for driving airside.

2.3 Aerodrome Regulations and Requirements

- a) Rules of the air and ATM procedures applicable to aerodromes as they relate to vehicles, particularly rights of way;
- b) Specific aerodrome regulations, requirements and local instructions;
- c) Local methods used to disseminate general information and instruction to drivers; and,
- d) Local methods used to disseminate information regarding works in progress.

2.4 Personal Responsibilities

- a) fitness to drive (medical/health standards) national or airport agreed requirements;
- b) issue and use of personal protective equipment such as high visibility clothing and hearing protection;
- c) general driving standards;
- d) no-smoking/no-drinking requirements airside;
- e) responsibilities with respect to foreign object debris (FOD) and fuel/oil spillage; and,
- f) responsibility for individuals to ensure vehicle is serviceable for the task and used correctly.

2.5 Vehicle Standards

- a) Condition and maintenance standards agreed at aerodrome and/or national level;
- b) The requirements to display obstruction lights and company insignia;
- c) Requirements and content of daily vehicle inspections;
- d) Agreed standards of aerodrome and company vehicle fault reporting and rectification; and,
- e) Local requirements for the issue and display of airside vehicle permits (AVP's).

2.6 General Aerodrome Layout

- a) The general geography of the local aerodrome;
- b) Aviation terminology used such as runway, taxiway, apron, roads, crossings, runway holding points, etc.;
- c) All aerodrome signs, markings and lights for both vehicles and aircraft;
- d) Specific reference to signs, markings and lights used to guard runways and critical areas; and,
- e) Specific reference to any controlled/uncontrolled taxiway crossing procedures.

2.7 Local Organizations

- a) The role of the Aerodrome Operator in setting and maintaining standards;
- b) The national aviation safety authority and its responsibilities;
- c) The national and/or local police and their involvement with airside driving;
- d) Other enforcement authorities dealing with vehicles, driving, health and safety.

2.8 Emergency Procedures

- a) Actions and responsibilities in a crisis situation (any accident or significant incident occurring on the airport);
- b) Action in the event of a vehicle accident;
- c) Specific action in the event of a vehicle striking an aircraft;
- d) Action in the event of fire;
- e) Action in the event of aircraft accident/incident; and
- f) Action in the event of personal injury.

2.9 Communications

- a) Radio procedures and phraseologies to be used, if applicable;
- b) Light signals used by ATM;
- c) Procedures to be used by vehicle drivers if lost or unsure of position;
- d) Local emergency telephone number; and
- e) How to contact the local aerodrome safety unit.

2.10 Practical Training (Visual Familiarization)

- a) Airside service roads, taxiway crossings and any restrictions during low visibility;
- b) Aprons and stands;
- c) Surface paint markings for vehicles and aircraft;
- d) Surface paint markings that delineate the boundary between aprons and taxiways;
- e) Signs, markings and lights used on the taxiway and help indicate runways ahead;
- f) Parking areas and restrictions;
- g) Speed limits and regulations; and
- h) Hazards during aircraft turnarounds and aircraft movements.

3. Framework for Maneuvering Area Vehicle Driver Training Programme

3.1 All drivers expected to operate on the maneuvering area of an aerodrome should obtain an ADP which has covered the programme detailed above. It is also expected that any driver who will drive on the maneuvering area will have obtained an agreed period of experience of general airside driving before training to operate on the maneuvering area.

3.2 The numbers of drivers permitted to drive on the maneuvering 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 firefighting;
- d) Essential engineering;
- e) ATM;
- f) Airline/handling agent for aircraft towing and runway crossings.

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

3.3.1 Aerodrome Regulations and Requirements

- a) Air traffic control rules, rights of way of aircraft;
- b) Definitions of movement area, maneuvering area, aprons, stands; and
- c) Methods used to disseminate information regarding works in progress.

3.3.2 Air Traffic Management

- a) Function of aerodrome control and its area of responsibility;
- b) Function of ground movement control and its area of responsibility;
- c) Normal and emergency procedures used by ATM relating to aircraft;
- d) ATM frequencies used and normal hand over/transfer points for vehicles;
- e) ATM call signs, vehicle call signs, phonetic alphabet, standard phraseology; and,
- f) Demarcation of responsibilities between ATM and apron control if applicable.

3.3.3 Personal Responsibilities

- a) Fitness to drive with particular emphasis on eyesight and colour perception;
- b) Correct use of personal protective equipment;
- c) Responsibilities with respect to FOD; and
- d) Responsibilities with respect to escorting other vehicles on the maneuvering area.

3.3.4 Vehicle Standards

- a) Responsibility to ensure vehicle used is fit for purpose and task;

- b) Requirements for daily inspection prior to operating on the maneuvering area;
- c) Particular attention to the display of obstruction and general lights; and
- d) Serviceability of all essential communications systems with ATM and base operations.

3.3.5 Aerodrome Layout

- a) Particular emphasis on signs and markings and lights used on the manoeuvring area;
- b) Special emphasis on those signs, markings and lights used to protect the runway;
- c) Description of equipment essential to air navigation such as instrument landing system (ILS);
- d) Description of protected zones related to ILS antenna;
- e) Description of ILS protected areas and their relation to runway holding points;
- f) Description of runway instrument/visual strip, cleared and graded area; and,
- g) Description of lights used on the maneuvering area with particular emphasis on those related to low visibility operations.

3.3.6 Hazards of Maneuvering Area Driving

- a) Engine suction/ingestion and blast, vortex, propellers and helicopter operations;
- b) Requirements for driving at night;
- c) Requirements for operations in low visibility and other adverse weather conditions;
- d) Procedures for vehicle and or radio becoming unserviceable while on maneuvering area; and,
- e) Rights of way for aircraft, towed aircraft and rescue and firefighting services (RFFS) vehicles in emergency.

3.3.7 Emergency Procedures

- a) Actions to be taken in event of vehicle accident/incident;
- b) Actions to be taken in event of aircraft accident/incident;
- c) Actions to be taken if FOD or other debris is found on runways and taxiways;
- d) Procedures to be used by vehicles if lost or unsure of position; and,
- e) Local emergency telephone number.

3.3.8 Aircraft Familiarization

- a) Knowledge of aircraft types and ability to identify all types normally operating at the aerodrome;
- b) Knowledge of airline call signs; and,
- c) Knowledge of aircraft terminology relating to engines, fuselage, control surfaces, undercarriage, lights, vents etc.

3.3.9 Practical Training (Visual Familiarization)

- a) All runways (including access and exit routes), holding areas, taxiways and aprons;
- b) All signs, surface markings and lights associated with runways, holding positions, CAT 1 or 2 operations;
- c) All signs, surface markings and lights associated with taxiways;
- d) Specific markings that demarcate the boundary between aprons and maneuvering area;
- e) Navigation aids such as ILS, protected area, antenna, RVR equipment and other meteorological equipment;
- f) Hazards of operating around aircraft landing, taking off or taxiing; and,
- g) Any locally used naming convention for particular areas or routes.

4. Framework for a Radiotelephony (RTF) Training Programme

4.1 The movement of vehicles on the maneuvering area is subject to authorization by ATM. Depending upon the complexity of the aerodrome, ATM 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.

4.2 All drivers of vehicles operating on the maneuvering area should be expected to display a high degree of competence with respect to use of RTF phraseology and ICAO air-ground radiotelephony communications language requirements.

4.3 Hierarchy of Message Priority

Message priorities, understanding of distress, alerting, control, and information messages.

4.4 Use of the Phonetic Alphabet

Correct pronunciation of both letters, words and numbers.

4.5 Use of Standard Phraseology

- a) Emphasis on drivers using standard phraseology; and,
- b) Caution should be noted with certain phrases such as ‘cleared’, and ‘go ahead’.

4.6 Use of Call Signs for Aircraft, ATM and Vehicles

- a) Understanding of terminology and acronyms used by ATM and pilots;
- b) Knowledge of the airline call signs used at the aerodrome; and,
- c) Vehicle call signs should be appropriate to function e.g. ‘Operations’, ‘Fire’, ‘Engineer’, where there are more than one vehicle the use of numbers e.g. ‘Fire 2’.

4.7 Use of Read back Procedures

Vehicle drivers should use standard read back in the same manner as pilots for instructions such as ‘enter/cross the runway’, and if conditional clearances are used.

4.8 Readability Scale

Understanding and use of the readability scale from 1 – 5.

4.9 Lost or Uncertain of Position

Understanding of local procedures for vehicles lost or uncertain of position on the maneuvering area.

4.10 Vehicle Breakdown

- a) Local procedure for vehicle breakdown on runways and taxiways; and,
- b) Procedure for indicating to ATM of vehicle failure.

4.11 Radio Fail Procedure

- a) Understanding of the local procedure if radio failure occurs whilst on the runway or taxiway; and,
- b) Understanding of the light signals that may be used by ATM to pass instructions to vehicles.

4.12 Correct Transmitting Technique and RTF Use

- a) understand the reasons for listening out prior to transmitting
- b) use of standard phraseology and ICAO air-ground radiotelephony communications procedures (there are no language requirements for vehicle drivers);
- c) words and sounds to be avoided;
- d) correct positioning of microphones to avoid voice distortion;
- e) avoidance of ‘clipped’ transmissions;
- f) be aware of regional accents and variations of speech; and,
- g) speed of delivery of RTF phraseology.

4.13 Use of Portable Radios

- a) correct use of radios;
- b) effective range and battery life;
- c) screening/shielding effects on the aerodrome; and,
- d) use of correct call signs, either related to vehicle or an individual person.

4.14 Safety while using Radios

- a) local instructions regarding use of portable radios and hand held microphones while driving a vehicle; and,
- b) local instructions on the use of mobile telephones while operating airside.

4.15 All of the three training programmes should consist of two main parts:

- i) Classroom/theoretical part which should include the use of prepared presentations, maps, diagrams, video, booklets, checklists as appropriate.
- ii) The second part should involve practical training and visual familiarization on the aerodrome with a suitably trained person. This practical tuition will take a period of 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.
- iii) Where responsibility for vehicle driver training (apron and maneuvering area) and RTF is delegated to a third-party provider the aerodrome management should institute a programme of audits, as part of its SMS, to ensure that agreed standards are being maintained.

The above frameworks are intended only as a guide and are based on current 'good practice'. It is incumbent on aerodromes to regularly review their vehicle driver training programmes against programmes and documentation available across the industry.

APPENDIX E: AERODROME RESOURCE MANAGEMENT TRAINING COURSE

1. INTRODUCTION

An analysis of many runway incursions has established that a number of these incidents were the result of a breakdown in team function of air traffic controllers, air crew or vehicle drivers. This may be due to incorrect communication practices or a failure to understand the roles and difficulties of those from other areas.

A training course, known as Aerodrome Resource Management, has been produced by EUROCONTROL and is intended to enhance the team role between all involved in runway operations. This course can be implemented at individual aerodromes or alternatively regional seminars can be organised. The course places emphasis on developing the team role at each airport and also building an understanding for all staff on the exact tasks and difficulties of others who operate on the maneuvering area.

2. COURSE DESCRIPTION

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 the local causal factors of runway incursions and identify local solutions to prevent their recurrence.

Today, all three members of this multi-professional team are working at the forefront of operational safety as individuals; they need to be a team on the maneuvering area.

The Aerodrome Resource Management course is designed to train trainers to facilitate the members of local runway safety teams and all operational staff working on the maneuvering area.

The course is applied to raise awareness of the operational hazards faced every day when working on or around a runway. The human factors focus reveals the importance of communication, error management and situational awareness for this group of staff.

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 .

APPENDIX F: RUNWAY INCURSION INITIAL REPORT FORM

Report Number.....

ICAO MODEL RUNWAY INCURSION INITIAL REPORT FORM

A.	Date/time of incident (<i>in UTC</i>) (YYYYMMDDhhmm	Day	Night
B.	Person submitting the report: Name	Job Title	Telephone
	Facility/Unit	Date/time/place of completion of form	
C.	ICAO Aerodrome Designator		
D.	Surface Condition		
E.	Aircraft, vehicle or person involved in the runway incursion(<i>Indicate those involved in the incident</i>)		
	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 (Make selection from list)	No	Yes
	Cancelled takeoff clearance	Rejected takeoff (distance rolled)	Rotated early
	Delayed rotation	Abrupt stop	Swerve
	Missed approach (distance to runway threshold)	Other	
H.	Evasive Action Aircraft 2 (Make selection from list)	No	Yes
	Rejected takeoff (distance rolled)	Rotated early	Cancelled takeoff clearance
	Abrupt stop	Swerve	Delayed rotation
	Other	Missed approach (distance to runway threshold)	
I.	Evasive Action Vehicle (Make selection from list)	No	Yes
	Swerve	Abrupt stop	Other
J.	Closest Proximity (CP)	Vertical (ft)	Horizontal (m)

K.	Communication Difficulties? (Make selection from list)	No	Yes	Read back / hearback
	Blocked communication	Partially blocked communication		Confused call- signs
	ACFT/vehicle on wrong frequency/no radio	Non-standard phraseology		
L.	Did the ATM forget about? (Multiple choices can be made)	No		Yes
	an ACFT/person/vehicle cleared onto or to cross a runway			
	an ACFT on approach to land a runway closure			
M.	Description of Incident and Relevant Circumstances (must include):			
	i) a description or diagram of the geometry of the incident scenario;			
	ii) a description of any evasive or corrective action taken to avoid a collision;			
	iii) an assessment of the available reaction time and the effectiveness of the evasive or corrective action;			

	iv) whether a review of voice communication has been completed and results of that review; and		
	v) initial assessment of severity.		
	v) initial assessment of severity.		
	AIRCRAFT / VEHICLE DETAILS		
N.	Aircraft 1	Reg. No.	Call sign
	SSR code (if applicable)	Flight No.	Owner/Operator
	Aircraft 1 type	Flight Details	Type of Flight Rules
	General Aviation IFR	Military VFR	Non-scheduled
	Scheduled	Other	Not applicable
O.	Aircraft 2	Reg No.	Call sign
	SSR code (if applicable)	Flight No.	Owner/Operator
	Aircraft 1 type	Flight Details	Type of Flight Rules

	General Aviation IFR	Military VFR	Non-scheduled
	Scheduled	Other	
P.	Vehicle 1	<i>Reg. No.</i>	<i>Call sign</i>
	<i>Mobile No.</i>	<i>Owner/Operator</i>	<i>Vehicle 1 type</i>
	<i>Vehicle Details</i>	<i>Type of Vehicle</i>	<i>Runway Inspection</i>
	<i>Other</i>	<i>Bird control</i>	<i>Tugging / Towing</i>
	<i>Fire Brigade</i>	<i>Maintenance</i>	<i>Snow clearing</i>
	<i>Military</i>		
Q.	Vehicle 2	Reg No.	Call sign
	Mobile No	Owner/Operator	Vehicle 2 type
	Vehicle Details	Type of Vehicle	Runway Inspection
	Other	Bird control	Tugging / Towing
	Fire Brigade	Maintenance	Mechanical sweeper.
	Military		

R.	Report received by (name of person)	Date	
S.	Date when detailed investigation will commence		

2. INSTRUCTIONS FOR THE COMPLETION OF RUNWAY INCURSION

INITIAL REPORT FORM

	Date/time UTC and conditions (day or night).
	Details of the person submitting the report.
	Aerodrome designator as indicated in <i>Location Indicators</i> (Doc 7910).
	Information regarding runway condition at the time of the incursion that affected the braking action of the aircraft.
	Identification of aircraft, vehicle and person involved in the runway incursion. More details should be provided in N, O, P, and Q.
	Information on weather conditions such as wind, visibility, RVR, temperature, ceiling, cloud and additional information as required.
	Information regarding evasive actions taken by aircraft and/or vehicle.
	Information regarding the closest proximity (CP) 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.
	Information regarding communications difficulties and ATM memory lapses.
	Describe the runway incursion, provide information requested. Attach additional papers as requested.
	Detailed information regarding aircraft and vehicles involved in the runway incursion.
	Name of person receiving the report and date.
	Date when detailed investigation of the runway incursion will commence.

APPENDIX G: RUNWAY INCURSION CAUSAL FACTORS

IDENTIFICATION FORM

Initial Runway Incursion Report Number-----

SSCAA RUNWAY INCURSION CAUSAL FACTORS IDENTIFICATION FORM		
A.		
Date/time/Place of incident <i>in (UTC)</i> (YYYY/MM/DD/hhmm) -----		
B. Aircraft, Vehicle or Person Involved in the Runway Incursion (<i>Indicate those involved in the incident</i>).		
Aircraft 1		
Aircraft 2		
Aircraft 3		
Vehicle		
Person		
C. Severity of Runway Incursion		
Accident		
A		
B		
C		
D		
E		
D. Causal and Coincident Factors (<i>Multiple choices can be made</i>)		
1.	<i>Air Traffic Control</i>	
1.1	<i>Communications</i>	
1.1.1	Transmitted instructions which were long, complex, spoken rapidly or in a language other	

	than ICAO air-ground radiotelephony communications language requirements (language normally used by the station on the ground or the English language)	
1.1.2	Did not obtain read-backs for clearances, instructions and coordination as required by ICAO	
1.1.3	Did not correct error in a read-back	
1.1.4	Issued clearance to 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 ICAO procedure, please briefly describe the procedure used). (Where?)	
1.2	<i>Situational Awareness</i>	
1.2.1	Head down time due to equipment/displays; duties other than traffic processing such as inputting flight data	
1.2.2	Forgot about:	
	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 has already been issued
	Closed runways	Vehicle on an active runway
	Vehicle cleared to cross a runway	
1.2.3(a)	Distractions due to Performing other assigned duties, such as	
	conducting operational telephone calls,	weather observations and recording,

	issuing NOTAM and other operational information	other
1.2.3(b)	Distractions due to Engaging in non-operational activities such as personal telephone call,	
	extraneous conversation,	
	reading material and radios	
	Used language other than ICAO air-ground radiotelephony communications language requirements	
	Other	
1.2.4	Misidentified aircraft or aircraft's position due to:	
	Incorrect position report	
	An incorrect expectation (e.g. expected the aircraft to be clear of the runway)	
1.2.5	A lack of visual scanning of ground movements	
1.2.6	ATM tower has limitations on the view of the maneuvering area	
1.2.7	Recent runway configuration change	
1.2.8	Unusual runway configuration	
1.2.9	Error occurred within 15 minutes of assuming the control position	
1.2.10	Controller was conducting on-the-job training	
1.2.11	Fatigue	
1.2.12	Other (please specify).	
1.3	<i>Staffing</i>	
1.3.1	ATM positions were combined on same frequency	
1.3.2	Absence of a supervisor in the tower	
1.3.3	Supervisor was working a control position	
1.4	<i>Decision Making</i>	

1.4.1	Misjudged separation or anticipated separation	
1.4.2	Inadequate ATM to ATM coordination	
1.4.3	Other (please specify).	
1.5	<i>Procedures</i>	
1.5.1	Misapplication of:	
	Conditional clearances	
1.5.2	Use of multiple line up clearances	
1.5.3	Other (please specify; If not ICAO procedure, please briefly describe the procedure used).	
1.6	<i>Aerodrome works</i> (Where?)	
1.6.1	ATM not advised of works on the maneuvering area	
1.6.2	Other (please specify).	
2.	<i>Flight Crew</i>	
2.1	<i>Communications</i>	
2.1.1	Transmission was completely blocked	
2.1.2	Transmission was partially-blocked “stepped-on”	
2.1.3	Accepted another 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 air-ground radiotelephony communications language requirements (language normally used by the station on the ground or the English language) in situation not covered by ICAO standard phraseology	
2.1.6	Used language other than ICAO air-ground radiotelephony communications language requirements (language normally used by the station on the ground or the English language)*	
2.1.7	Speech quality:	

	Not proficient in ICAO air-ground radiotelephony communications language requirements (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 ATM of a delay on the runway prior to take off	
2.1.11	Other (please specify).	
2.2	<i>Situational Awareness</i>	
2.2.1	Crew conducting checklists while taxiing	
2.2.2	Crew member programming Flight Management System or other flight deck system while taxiing * ICAO air-ground radiotelephony communications language requirements are shown in Annex 10 — <i>Aeronautical Telecommunications</i> , Volume II, Chapter 5 and Annex 1 — <i>Personnel Licensing</i> , Chapter 1 and its appendix.	
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	Mistook position on the aerodrome (thought they were in a different location)	
2.2.7	Fatigue	
2.2.8	Reported incorrect location to ATM	
2.2.9	Taxied fast	
2.2.10	Did not refer to the aerodrome diagram	
2.2.11	Did not listen to the ATIS	

2.2.12	Works on the maneuvering area 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	<i>Marking, Signs and Lighting</i>	
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	<i>Clearances and Instructions</i>	
2.4.1	Misunderstood clearance:	
	Conditional	
	Follow	
	Other	
2.4.2	Did not ask for clarification when flight crew did not understand clearance or instruction	
2.4.3	Did not inform ATM 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 wrong runway	
2.4.10	Landed or departed on taxiway	
2.4.11	Other (please specify).	
3.	<i>Vehicles and Pedestrians</i>	
3.1	<i>Communications</i>	
3.1.1	Not operating 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 ATM	
3.1.3	Other (please specify).	
3.2	<i>Situational Awareness</i>	
3.2.1	Forgot the details/limits of any clearance to operate on the maneuvering area	
3.2.2	Distracted by:	
	Current work	
	High noise levels	
	Monitoring more than one frequency and possibly a mobile telephone	
	Disoriented or lost on the aerodrome	
3.2.3	Failure to report correct location	
3.2.4	Other (please specify).	
3.3	<i>Markings, Signs and Lighting</i>	
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	<i>Procedures</i>	
3.4.1	Not adequately familiar with the aerodrome and its procedural requirements	
3.4.2	Did not refer to current aerodrome NOTAM	
3.4.3	Did not refer to current aerodrome diagram	
3.4.4	Used out of date or inaccurate publications or charts	
3.4.5	Did not advise ATM of work that affected operations	
3.4.6	Ground vehicles did not stop at required positions	
3.4.7	Other (please specify).	
3.5	<i>Clearances and Instructions</i>	
3.5.1	Did not comply with ATM clearances and instructions	
3.5.2	Mistook as theirs, a clearance intended for another vehicle or an aircraft	
3.5.3	Did not advise ATM that the driver did not understand the clearance or instruction	
3.5.4	Other (please specify).	

E. Person Submitting the Form:

Name:.....
.....

Title:
.....

Date:.....
.....

**APPENDIX H: INSTRUCTIONS FOR THE COMPLETION OF RUNWAY
INCURSION CAUSAL FACTORS IDENTIFICATION FORM**

ITEM	Factors
1.	Date/time in UTC and place where the runway incursion occurred.
2.	Identification of aircraft, vehicle and person involved in the runway incursion.
3.	Classify the severity of the runway incursion according to Manual for Preventing Runway Incursions.
4.	Fill all causal and coincident factors applicable to the runway incursion incident.
5.	Details of the person submitting the form and date.
6.	<i>Note. — When instructed by ICAO, the information on this form should be sent to ICAO to allow global identification of runway incursion casual factors.</i>

APPENDIX I: AERODROME RUNWAY INCURSIONS ASSESSMENT (ARIA)

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 have a higher vulnerability than others do. ARIA should make the important differences visible. The outcome of the model is a vulnerability index that is related to the runway incursion rate. The model is developed using taxonomy – based approach. ARIA is a simple, easy-to-use Model, with the potential to be used for airports located worldwide.

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.).

APPENDIX J: RUNWAY SAFETY TEAM SET-UP CHECKLIST

Item	Question	Response	Comments
1. Terms of Reference (ToR)			
1.1	Is there a ToR agreement in place?	☐ Yes ☐ No	
1.2	Does the ToR define the scope of work of the RST?	☐ Yes ☐ No	
1.3	Does the ToR define the roles for members of the RST?	☐ Yes ☐ No	
1.4	Does the ToR define a process for handling data/reports received from the participating organizations?	☐ Yes ☐ No	
1.5	Does the ToR describe the decision-making process to be used by RST?	☐ Yes ☐ No	
1.6	Does the ToR define a process for resolving disagreements between RST members?	☐ Yes ☐ No	
2. Hazard identification			
2.1	Does the RST have a formal safety data collection and processing system for documenting operational hazards?	☐ Yes ☐ No	
2.2	Do all RST members contribute to the formal safety data collection and processing system by sharing identified operational hazards?	☐ Yes ☐ No	
2.3	Does the RST define and document specific consequences for the operational hazards?	☐ Yes ☐ No	
3. Safety Risk Management			
3.1	Does the RST have a formal process to manage the operational risk?	☐ Yes ☐ No	
3.2	As part of the risk management process, are the consequences of the operational hazards assessed in terms of probability and severity?	☐ Yes ☐ No	
3.3	Is there a formalized process to determine the level of risk the RST is willing to accept?	☐ Yes ☐ No	
3.4	Does the RST develop risk mitigation strategies to control the level of risk within the operational environment?	☐ Yes ☐ No	
3.5	Is there a formalized process for the RST to make recommendations to applicable stakeholders?	☐ Yes ☐ No	
3.6	Is there a formalized process to document the decisions made by the RST during the risk management process?	☐ Yes ☐ No	
3.7	Are the decisions made by the RST periodically reviewed to determine if the desired effect was achieved by their mitigations/recommendations?	☐ Yes ☐ No	
4. Communication			

4.1	Does the RST have a formal process to communicate with applicable stakeholders?	☐ Yes ☐ No	
4.2	Does the RST periodically provide runway safety material to key frontline employees?	☐ Yes ☐ No	
4.3	Does the RST participate in information sharing activities with other RSTs?	☐ Yes ☐ No	
4.4	Does the RST solicit safety-related information from all airport users via common links embedded within websites of the RST participating organizations?	☐ Yes ☐ No	
5. Continuous improvement			
5.1	Does the RST have a formal process to continuously improve their processes & products?	☐ Yes ☐ No	
5.2	Does the RST engage in formal, periodic reviews of their programme to ensure they are improving runway safety?	☐ Yes ☐ No	
5.3	Are the results of the continuous improvement programme documented?	☐ Yes ☐ No	

APPENDIX K: RST MEETING ORGANIZER TOOL

(EXAMPLE)

1. Schedule Meeting

Date:

Time:

Location:

2. Determine Invitees

- Aerodrome Operators;
- Air Traffic Services;
- Commercial Air Operators;
- Representatives of flight crew familiar with the aerodrome;
- Members from the general aviation community (if applicable);
- Technical experts of controller associations; and,
- Technical experts of pilots' associations.

The Team may also include:

1. The regulatory authority;
2. Military operator (if applicable, based on joint use of the airport or other military roles);
3. Support services (de-icing, catering, ground handling, etc.);
4. Emergency response service providers;
5. Subject matter experts (meteorologists, ornithologists, accident investigation authority, etc.) (upon invitation); and,

Consideration may be given to periodically inviting members of other RSTs to enable sharing of information and learning.

3. Plan Discussion Topics

-Three weeks prior to the meeting date:

Notify stakeholders of the meeting date, time, and location. - Solicit input for agenda items from each of the members.

-Two weeks prior to the meeting date: - Schedule airport tours (as required). - Send tentative agenda to the team.

-One week prior to the meeting date:

Consolidate updates and information received from members.

Distribute the final agenda and supporting documents to the team.

4. Meeting Logistics

Confirm availability of members

Schedule meeting room appropriate for the size and requirements of the RST

Coordinate airfield tour with airport management , tower, etc., including vehicle and escort availability.

APPENDIX L: RUNWAY SAFETY TEAM MEETING AGENDA

(EXAMPLE)

1. Meeting information

Date:

Time:

Location:

2. Members and guests in attendance

- i. Aerodrome Operators;
- ii. Air Traffic Services;
- iii. Commercial Air Operators;
- iv. Representatives of flight crew familiar with the aerodrome;
- v. Members from the general aviation community (if applicable);
- vi. Technical experts of controller associations; and
- vii. Technical experts of pilots' associations.

The team may also include:

- i. The regulatory authority;
- ii. Military operator (if applicable, based on joint use of the airport or other military roles);
- iii. Support services (de-icing, catering, ground handling, etc.);
- iv. Emergency response service providers;
- v. Subject matter experts (meteorologists, ornithologists, accident investigation authority, etc.) (upon invitation); and
- vi. Consideration may be given to periodically inviting members of other RSTs to enable sharing of information and learning.

3. Previous business [Review the status of previous action items and update the Action log as appropriate]

4. New business [Members present new projects, hazards, or events identified within their safety]

5. Management systems.

The team then:

- (a) defines the hazards,
- (b) conducts safety risk assessments, and
- (c) proposes recommendations for managing the safety risk]

6. Action log [Document findings and action plan]

7. Next meeting [Agree to the date, time, and location for the next meeting]

Note.— Airport tour [refer to 3.3.3 – the intent of the airport tour is to identify existing and new hazards as well as to observe rectification measures that have been implemented based on previous findings. The most suitable time for the tour, if conditions permit, is between Agenda Item 3 and 4.]

APPENDIX M: RUNWAY SAFETY MANAGEMENT FORM

Runway Safety Management Form						
Reference:	Date Opened: dd/mm/yy	Date Closed: dd/mm/yy				
General Information						
Airport:	What area is affected: ☐ runway ☐ taxiway ☐ ramp ☐ general					
Specific Identifier (runway/taxiway identifier):						
Safety Outcomes						
Safety Risk Type:	☐ Runway Excursion	☐ Runway Incursion - Aircraft	☐ Wildlife Encounter			
	☐ Abnormal Landing	☐ Runway Incursion - Vehicle	☐ Birdstrike			
			☐ Runway Confusion			
			☐ Other (Specify)			
Has an event occurred, or is this a hazard (potential outcome):		☐ actual outcome (event occurred)	occurrence date dd/mm/yy			
		☐ potential outcome (no event occurred)				
Description of actual or potential outcome						
Supporting Document Type: ☐ Accident Report ☐ Incident Report ☐ Audit Report ☐ Other (Specify)						
Safety Issues						
☐ Navigation Aids	☐ Meteorological	☐ Approach Vectoring	☐ Other			
☐ Runway/Taxiway Marking	☐ Obstacles	☐ Runway Surface Condition				
☐ VASI / PAPI	☐ Approach lights	☐ Airport Construction				
☐ Communications	☐ Runway/Taxiway Lights	☐ Procedures				
<i>Once you have completed the identification of the safety issues - please submit the form to log this report.</i> <i>During the runway safety team meeting you should address each of the reports as an item on the agenda.</i> <i>The following sections are provided as a tool to manage the outcomes of the meeting.</i>						
Risk Assessment						
(The risk assessment portion is to be completed as part of the runway safety team meeting)						
What is the Severity of occurrence:		☐ Catastrophic ☐ Hazardous ☐ Major ☐ Minor ☐ Negligible				
What is the Likelihood of occurrence:		☐ Frequent ☐ Occasional ☐ Remote ☐ Improbable ☐ Extremely Improbable				
Risk Level (from below risk table):		☐ High ☐ Moderate ☐ Low				
<i>If the risk level is Moderate or High, a corrective action plan is required</i>						
Severity	Likelihood					
		Certain / Frequent	Likely / Occasional	Possible / Remote	Unlikely / Improbable	Exceptional / Impossible
	Catastrophic	High	High	High	Moderate	Moderate
	Major	High	High	Moderate	Moderate	Moderate
	Moderate	High	Moderate	Moderate	Moderate	Low
	Minor	Moderate	Moderate	Moderate	Low	Low
	Insignificant	Low	Low	Low	Low	Low
Corrective Action Plan						
(The corrective action plan is based on the recommendations of the Runway Safety Team and is to be completed as part of the Runway Safety Team meeting)						
Action Plan Description:						
Action Item Description:						
Executing Body:		Implementation date: dd/mm/yy		Status:		
Action Plan Description:						
Action Item Description:						
Executing Body:		Implementation date: dd/mm/yy		Status:		

APPENDIX N: LIST OF NATIONAL/LOCAL AGENCIES AT AN AIRPORT EXPECTED TO PARTICIPATE IN AN RS GO-TEAM MISSION

The RS Go-Team mission activities should include the participation of representatives from the following as applicable to runway safety (users of the manoeuvring area) at the airport and as needed for the Go-Team mission objectives, expected to be the same as the existing and planned members of the airport Runway Safety Team (RST). The participants are to be invited by the RST chair and/or airport operator.

- Aerodrome Operators;
- Air Traffic Services;
- Commercial Air Operators;
- Representatives of flight crew familiar with the aerodrome;
- Members from the general aviation community (if applicable);
- Technical experts of controller associations; and
- Technical experts of pilots' associations.

The team may also include:

- The regulatory authority;
- Military operator (if applicable, based on joint use of the airport or other military roles);
- Support services (catering, ground handling, etc.);
- Emergency response service providers;
- Subject matter experts (meteorologists, ornithologists, accident investigation authority, etc.) (upon invitation); and,
- Consideration may be given to periodically inviting members of other RSTs to enable sharing of information and learning.
- Consideration should be given to periodically inviting members of other airport RSTs to enable sharing of information and lessons learned.

APPENDIX O: TEMPLATE FOR RS GO-TEAM ON-SITE MISSION PROGRAMME/AGENDA

Day 1	– Registration and Opening – The Runway Safety Program - Perspectives – Global – ICAO Global Runway Safety Programme – Related ICAO SARPS, PANS and guidance material – Regional – RASG - Safety Enhancement Initiatives, Detailed Implementation Plans and Annual Safety Report – Local – Regulator – ANSP – Air Operator – Airport operator – Other Service providers at the airport
Day 2	– Safety management – Hazard Identification – Risk Assessment – Safety Oversight – The Runway Safety Team (RST) – Introduction – The ICAO RST handbook – Implementation of the RST – Terms of reference for the RST – Responsibilities – Sharing and use of safety information Airport's briefing – Identification of Hot Spots – Safety briefing (Identification, safety vests, instructions, leaders, communications, clearance, traffic, etc.)

Day 3	– Airport visit – the intent of the airport visit is to identify existing and new hazards as well as to observe rectification measures that have been implemented based on previous findings. – ATC Control Tower – Runway and runway strips – Taxiways and taxiway strips (focusing on runway safety issues only) – Runway End Safety Areas (RESA) – Visual aids – Obstacle control – FOD control and management – Wildlife control and management
	– Any active construction sites – Debriefing after the visit to the airport – Members present new projects, hazards, or events identified by the RST and its stakeholder's own safety management systems. – The team then: – defines the hazards, – identifies the safety risk assessments to be conducted, and – proposes recommendations for managing the safety risk – reviews arrangements to ensure the sustainability of the RST
Day 4 (halfday)	– Go-Team draft report for RST – Action log : Document findings and action plan – Conclusions and closing

APPENDIX P: LIST OF REQUIREMENTS IN STATE/AIRPORT FOR THE GO-TEAM MISSION

1. Focal point coordinator
2. Administrative support staff
3. Meeting room & audio-visual equipment
4. Simultaneous interpretation (if required)
5. Transportation to/from airport, meeting venue and hotel for team
6. Refreshments/ amenities
7. Invitation of local participants
8. Coordinate the schedule for the meetings and mission
9. Airport visit coordination, e.g. security access, transportation, facilitation, IDs, safety equipment (vests, etc.)
10. Coordinate the presentations by national and local organizations
11. Prepare reference documents, information and data

APPENDIX Q: AN EXAMPLE OF RST CASE

Note.— This material is offered as an example “case scenario” only and not intended to serve as a standard for how RST meetings should be conducted. The authors of this handbook recognize that the procedure used by a particular RST is dependent on the needs, capabilities, and complexities of the participating organizations.

Meeting Preparation

Three weeks prior to the meeting, the Chairperson solicited input for agenda topics from each of the members. In response to this request, the airport manager indicated that he would like to discuss a planned construction project near the approach end of one of the parallel runways. After receiving input from the rest of the members, the Chairperson consolidated the information and distributed the agenda to the team one week prior to the meeting date.

Attendance

The following attendees were present during the meeting:

- Tower Supervisor (Chairperson), voting member.
- Airport Manager, voting member.
- Airline Operations Manager, voting member.
- Flight School Operations Manager, voting member.
- Airport Safety Manager (RST Secretary), supporting member.
- Fire Chief, routinely invited guest.
- Regulator, routinely invited guest.
- Construction Foreman, subject matter expert invited by the Airport Manager.

Previous Business

During this phase of the meeting, updates to previous action items were discussed and documented on the Action Log. Communication plans were reviewed and the next issue of the airport newsletter was presented.

New Business

Following the Previous Business, the Chairperson asked each member to present the new hazards and issues identified through their respective safety management systems. When it was his turn, the Airport Manager asked the Construction Foreman to brief the team on the upcoming construction project. The Construction Foreman provided the following details to the RST:

- In an effort to address water accumulation issues, the airport plans to install a drainage system near the approach end of the secondary runway.
- Given the location of the worksite, construction vehicles must cross the primary runway.
- In an effort to reduce the impact on the arrival rate, the work is scheduled to occur at night.
- In an effort to reduce the likelihood of a runway incursion by a construction vehicle, each driver will be required to attend a special training course and escorts will be used during the project.

System Description

The Runway Safety Team discussed how the airport system would be affected by this project. Their comments were documented by the airport Safety Manager and included the following:

- There will be a high volume of construction vehicles wanting to cross the primary runway during night operations.
- The tower may have difficulty in communicating directly with the drivers of the construction vehicles.
- Signs, markings, and lighting for taxiways and runways will be modified during the period of construction.

Hazard Identification

The RST then described the hazards and possible consequences associated with this project. The airport Safety Manager (in his role as the RST Secretary) captured the following comments:

- Generic Hazard: Airport Construction.
- Specific Hazard: Construction vehicles crossing the primary runway.
- Consequences of the Hazard:
 - Construction vehicles may deviate from the prescribed procedures and cross the primary runway without clearance.
 - Aircraft could conflict with a crossing vehicle.

Safety Risk Assessment Process

The RST Secretary documented the following results of the risk assessment process:

- The RST concluded there is a remote probability that a construction vehicle will deviate from prescribed procedures and cross the primary runway without an escort.
- Given there is a night airfreight operation at the airport, the RST concluded there is a remote probability an aircraft could conflict with a crossing vehicle.
- While the probability of an aircraft/construction vehicle conflict is remote, the RST assessed that, should such conflict occur, the severity of the occurrence could be catastrophic.
- The RST assessed existing defenses (driver training programme, use of escorts for construction vehicles, signs, markings and lighting).
- Using their safety risk assessment matrix and their safety risk tolerability matrix, the RST assessed the safety risk index as *3A* (“unacceptable under the existing circumstances”).
- The RST concluded, therefore, that the safety risk of the consequences of the hazard generated by movement of construction vehicles to the construction site is, under the prevailing conditions, unacceptable and that control/mitigation is necessary.

Safety Risk Control Process

- Given the conflict between the need to address the drainage issues by the airport and the unacceptability of the assessed risk by the RST, an adjustment to the original plan must be made.
- While reviewing the airport diagram, one of the members suggested using the perimeter road to gain access to the construction site while continuing to use the escort vehicles to guide the construction crew.
- With this mitigation as part of the plan, the RST used the same process to assess the probability and severity of the consequences of the hazards and determined that, although the severity would remain catastrophic, the likelihood would drop to “extremely improbable.”
- This resulted in an assessment value of *1A* (“Acceptable based on risk mitigation. It may require management decision”) using the safety assessment matrix.
- The RST documented this recommendation in the Action Log and tasked the Airport Manager with the responsibility for ensuring their recommendation was communicated to Airport Authority prior to beginning construction.

- The Chairperson then added an item to the next RST meeting agenda requesting a follow-up on the status of this recommendation and the project.

Action Log Documentation

Throughout the meeting the RST Secretary documented the process in the Hazard Identification and Safety Risk Management Log. The purpose of this log is to provide a useful method for tracking recommendations and as a reference for future safety risk assessments. The log should be retained permanently in the “safety library” under the care of the current Chairperson.

APPENDIX R: LIST OF USEFUL REFERENCES

1. Advanced Surface Movement Guidance and Control Systems (A-SMGCS) Manual (ICAO Doc 9830)
2. Aerodrome Design Manual (ICAO Doc 9157)
3. Airport Services Manual (ICAO Doc 9137)
4. Procedures for Air Navigation Services –Aerodromes (PANS-Aerodromes) (ICAO Doc 9981)
5. Circular 355 Assessment, Measurement and Reporting of Runway Surface ConditionsGlobal Air Traffic Management Operational Concept (Doc 9854)
6. Human Factors Guidelines for Air Traffic Management (ATM) Systems (ICAO Doc 9758)
7. Hazardous to Civil Aircraft Operations (ICAO Doc 9554)
8. Hazards at Aircraft Accident Sites (ICAO Cir 315)
9. Human Factors Digest No. 17 — Threat and Error Management (TEM) in Air Traffic Control (ICAO Cir 314)
10. ICAO Annex 19 to the Convention on International Civil Aviation, Safety Management
11. Manual of All-Weather Operations (ICAO Doc 9365)
12. Manual on Airspace Planning Methodology for the Determination of Separation Minima (ICAO Doc 9689)
13. Manual on Air Traffic Management System Requirements (ICAO Doc 9882)
14. Manual on Certification of Aerodromes (ICAO Doc 9774)
15. Manual on ICAO Bird Strike Information Systems (IBIS) (ICAO Doc 9332)
16. Manual on the Prevention of Runway Incursions (ICAO Doc 9870)
17. Manual on Required Communication Performance (RCP) (ICAO Doc 9869) - Manual on Simultaneous Operations on Parallel or Near-Parallel Instrument Runways (SOIR) (ICAO Doc 9643)
18. Manual of Surface Movement Guidance and Control Systems (SMGCS) (ICAO Doc 9476)
19. Operation of New Larger Aeroplanes at Existing Aerodromes (ICAO Cir 305) - Reducing the Risk of Runway Incursions (Flight Safety Foundation, May 2009)
20. Safety Management Manual (ICAO Doc 9859, 3rd edition)
21. ICAO Annexes 6, 11, 14 and 19 to the Convention on International Civil Aviation
22. ACI Airside Safety Handbook and Wildlife Management Handbook

23. CANSO Runway Safety Maturity Checklist
24. CANSO Flyer – Avoiding Unstable Approaches
25. CANSO Flyer – Runway Excursions
26. European Action Plan for the Prevention of Runway Excursions
27. European Action Plan for the Prevention of Runway Incursions
28. FAA Runway Safety: A Best Practices Guide to Operations and Communications
29. FAA Guide to Ground Vehicle Operations
30. FAA Pilot's Guide to Airport Signs and Markings Drilled Card
31. FAA Pilot and Flight Crew Taxi Procedures at Towered Airports Drilled Card
32. Runway Safety Programme (FAA Order 7050.1A)
33. IATA Pilot / ATC Phraseology Report
34. IATA REER Toolkit
35. IFALPA Runway Safety Manual

An ICAO iKit is available, containing available Runway Safety Products from various stakeholders at http://cfapp.icao.int/tools/RSP_ikit/story.html

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