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EUROCONTROL

European Action Plan for the Prevention of Runway Incursions

EAPPRI V3.0 – Released Issue

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CONTENTS

STATEMENT OF COMMITMENT

The rate and numbers of runway incursion reports remain steady. From the reports and data that are received, it is shown that there continue to be a minimum of two runway incursions every day in the European region. Accidents continue to take place on runways. Findings from those incident and accident reports have been used to determine the new recommendations and associated guidance materials contained in this update to the European Action Plan for the Prevention of Runway Incursions (EAPPRI).

The increasing availability of runway incursion incident reports is a positive indication of the commitment of organisations and operational staff to prevent runway incursions and runway accidents by learning from the past accidents and incidents and sharing this information across Europe.

The establishment of aerodrome local Runway Safety Teams (RST), which should comprise, as a minimum, representatives from Aircraft Operators, Air Navigation Service Providers and the Aerodrome Operator, is helping to facilitate effective local implementation of the recommendations. At the same time, aerodrome local Runway Safety Teams address runway safety specific issues relating to their own aerodrome.

Core to the new (and existing) recommendations contained in this document is the uniform and consistent application of ICAO and, increasingly, EU provisions. It is for the Regulator/ National Aviation Authority to decide upon the strategy for implementation at applicable aerodromes within its own State. The recommendations are mainly generic and it will be for the responsible organisations to decide specific details, after taking local conditions into account e.g. aerodromes where joint civilian and military operations take place.

The new recommendations are the result of the combined and sustained efforts of organisations representing all areas of aerodrome operations. The organisations that contributed to this action plan are totally committed to enhancing the safety of runway operations by advocating the implementation of the recommendations that it contains. These organisations include, but are not limited to, Aerodrome Operators, Air Navigation Service Providers, Aircraft Operators, and Regulators/National Aviation Authorities.

ORGANISATIONS AND LIST OF ACTIVE PARTICIPANTS INVOLVED IN THE PRODUCTION OF EAPPRI VERSION 3.0

The following organisations and persons have actively contributed to the review of EAPPRI Edition 2.0 and the production of this EAPPRI Version 3.0.

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It is further acknowledged that the following organisations were involved in the production of EAPPRI Edition 2.0 which forms the basis for this EAPPRIv3.0. .

ORGANISATION	
EUROPEAN AVIATION SAFETY AGENCY	EASA
BRITISH AIRPORTS AUTHORITY (NOW HEATHROW AIRPORT HOLDINGS LIMITED)	BAA
EUROPEAN COMMERCIAL AVIATION SAFETY TEAM (NOW SUSPENDED)	ECAST
INSPECTIE VERKEER EN WATERSTAAT, MINISTERIE VANINFRASTRUCTURE EN MILIEU (THE NETHERLANDS)	
INTERNATIONAL FEDERATION OF AIR TRAFFIC CONTROL ASSOCIATIONS	IFATCA
INTERNATIONAL COUNCIL OF AIRCRAFT OWNERS AND PILOT ASSOCIATIONS	IAOPA
INTERNATIONAL FEDERATION OF AIRLINE PILOTS ASSOCIATION	IFALPA

INTRODUCTION AND BACKGROUND

This version of European Action Plan for the Prevention of Runway Incursions (EAPPRI) recognises the emergence of EU provisions intended to improve runway safety in Europe. However, like its predecessors, this third version of EAPPRI continues to recognise the International Civil Aviation Organisation (ICAO) Standards and Recommended Practices (SARPS); it is therefore suitable for universal application. The ICAO runway incursion definition (also adopted by the EU) is "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."

Since the first release of the EAPPRI, aerodrome local Runway Safety Teams have been established at hundreds of airports across Europe. The implementation of the recommendations contained in the first and second versions of the Action Plan has been extensive, thanks to these teams and the organisations that support them. In 2008, the European Aviation Safety Agency (EASA) embedded this concept as an essential requirement to the European Union "EASA Basic Regulation", a key element in helping to raise the safety of runway operations at European airports. More recently, the Commission Regulation No 139/2014 (or "Aerodrome Regulation" as it is sometimes known), and its associated Acceptable Means of Compliance (AMC) and Guidance Material (GM), further elaborate the importance of these runway safety arrangements. Other EU legal instruments covering standardised European rules of the air (SERA); air operations; the reporting, analysis and follow-up of occurrences in civil aviation; common requirements for the provision of air navigation services; and technical requirements and administrative procedures relating to air traffic controllers' licences and certificates also impact runway safety to one degree or another.

Many operational staff have experienced a runway incursion and have contributed to the future prevention of runway incursions through incident reports. These reports have taught us that the majority of contributory and causal factors are concerned with communication breakdown, ground navigation errors and inadequate information in the cockpit.

The runway incursion problem remains a significant safety issue. One of the important challenges is that pilots and drivers on a runway without a valid ATC clearance believe they have permission to be there

WHAT'S CHANGED

The implementation of Safety Management Systems (SMS) and the establishment of aerodrome local Runway Safety Teams (RST) have undoubtedly enabled aircraft operators, air navigation service providers and aerodrome operators to improve operational runway safety. In the spirit of continuous improvement, however, new recommendations in this document challenge industry partners and regulators to re-assess the effectiveness of these working arrangements and practices to ensure that they continue to be optimised to deliver safe runway operations, including the prevention of runway incursions. Practical use of the ICAO runway incursion definition is intended to allow runway incursion data to be compared, common causes and contributory factors to be identified and lessons to be shared. However, experience has shown that these ideals are threatened because the interpretation of the definition still varies across the industry. Further work may be necessary, but as an intermediate step a new appendix provides additional guidance aimed at improving the overall consistency of runway incursion data and a better understanding of runway collision risk.

Aerodrome vehicle driving operations are an ongoing hazard for safe runway operations. A number of new recommendations and associated guidance would further strengthen the existing comprehensive barriers, if implemented. The use of synthetic trainers (simulators) to train airside drivers is bringing economic and operational benefits to some airports. Control and management of aerodrome works in progress/contractors are given more prominence in this document; additional aerodrome design considerations are also promoted.

Operational safety studies continue to show that the H24 use of stop bars can be a powerful runway incursion prevention barrier. Previous editions of EAPPRI included H24 stop bar use in Guidance Material but in this version the practice is elevated to Recommendation status for aerodrome operators and air navigation service providers to consider.

Regulators and national aviation authorities have an important role to play in setting the national tone as far as runway safety and runway safety promotion is concerned. New Recommendations ask national authorities to strengthen this activity and their oversight of operators' SMS.

This document recognises the proliferation of aeronautical information (e.g. NOTAMs) that pilots, in particular, are expected to assimilate. New Recommendations call for improvements of Aeronautical Information Management (AIM) and the simplification of the way it is presented. The aspiration to present aerodrome NOTAM information in a digitised, interoperable exchange format (i.e. graphical display) should be continued.

Emerging technologies such as those associated with Remote Tower Operations (RTO) present opportunities and threats as far as maintaining the safety on and around runways is concerned. Similarly, authorised remotely piloted aircraft systems (RPAS) or 'drones' need to be accommodated on and around aerodromes whilst ensuring the continuation of safe operations.

Other technologies on the ground (in ATC and/or on the aerodrome) as well as those on board aircraft are becoming increasingly available. Given that EAPPRI's status is wholly advisory, it is not appropriate to make direct recommendations to implement these various technologies. However it is right to acknowledge their presence and provide brief information and guidance so that operational practitioners can make further enquiries to decide for themselves the merits, or otherwise, of certain technological advances as applicable in their local operation.

Examples of aerodrome local Runway Safety Team achievements are contained in the guidance materials shown in the appendices to this document and some are also highlighted below.

ICAO

ICAO has introduced Annex 19, Safety Management to bolster the industry wide implementation of Safety Management Systems (SMS). In addition, it has published Doc. 9981, PANS Aerodromes (PANS ADR) to provide more information about aerodrome operations including the prevention of runway incursions; a new edition is planned to be published in 2019 and to become applicable in 2020. The ICAO Aerodrome Design and Operations Panel also continues to develop SARPs for runway safety in Annex 14 – Aerodromes, Volume 1 - Aerodrome Design and Operations, as well as PANS Aerodromes. ICAO is also developing a new high-level runway safety strategy document to support the future ICAO Global Aviation Safety Plan (GASP).

At a more grassroots level, ICAO published the second edition of the Runway Safety Team (RST) Handbook in 2015; this document provides practical guidance about how to set up and manage aerodrome local RSTs. ICAO also established the concept of RST Go-Teams to assist States and airports in establishing RSTs.

EU and EASA

New EU Regulations have been introduced in recent years. These regulations, covering aerodrome operations, occurrence reporting and design, are aimed at establishing safe operations of aerodromes and ensuring that every effort is made to reduce the number of accidents and incidents (including those affecting runway operations). Moreover, EASA is placing more focus on Safety Promotion activities and incorporates runway safety actions in the European Plan for Aviation Safety (EPAS).

SESAR

The Single European Sky ATM Research (SESAR) project has developed, and is developing, a number of technological solutions to improve airport operations; many of these have direct or indirect safety benefits. A SESAR deployment plan is in place to manage the implementation of these new and emerging technologies; some of those that can potentially help prevent runway incursions are described, in brief, in Appendix M.

EUROCONTROL – Network Manager

Since 2011, the EUROCONTROL Network Manager has introduced the concept of 'Top 5' Safety priorities. Some of these priorities are related to runway incursion prevention. Associated 'Top 5' Operational Safety Studies covering 'landing without ATC clearance', 'detection of occupied runway' and 'sudden high energy runway conflicts' have been commissioned. The resulting reports serve as a cross domain reference and source of information and advice in case stakeholders undertake operational safety and improvement to address each priority area.

Airport Council International (ACI)

ACI has introduced its Airport Excellence (APEX) in Safety Programme which is designed to help airports identify and mitigate aviation safety vulnerabilities through peer review missions, education, mentoring and best practice guidance. This activity is complementary to the ICAO RST Go-Teams concept/model (and vice versa).

IFALPA/ECA/ACI

IFALPA, in conjunction with ACI, is developing a method for naming taxiways, runways and their intersections and holding positions, to remove ambiguity. This method is being considered by ICAO and new guidance to industry is expected to be published in the future.

Civil Air Navigation Services Organisation (CANSO)

To support the management of runway safety risk, CANSO has introduced a Runway Safety Maturity Checklist which is designed to help organisations identify and prioritise areas for runway safety improvement from different perspectives.

IMPORTANT AND URGENT ACTIONS

Runway incursions are still considered one of the most serious safety threats amongst operational personnel.

The publication of this 3rd edition of the European Action Plan for the Prevention of Runway Incursions (EAPPRI) provides an opportunity for aviation industry stakeholders and organisations to re-focus and re-energise their runway incursion prevention activities.

As a starting point, it is suggested that organisations review and re-assess their implementation of the recommendations from the previous version before embarking on the implementation of the new recommendations in this document. Special attention should be given to ensuring that SMSs provide the necessary support (processes, procedures, practices) to facilitate effective runway incursion prevention activities. In addition, aerodrome local Runway Safety Teams should re-assess all aspects of their work to ensure that they are delivering effective runway safety outcomes.

Aerodromes which have not yet established a local Runway Safety Team are encouraged to do so - proportionate to their size and complexity - as soon as possible.

As in the previous edition, this version of EAPPRI continues to emphasise the need for a mutual exchange of information and data between organisations in order to facilitate lesson learning and assisting in the enhancement of runway safety.

To assist your organisation to plan this activity, the following generic approach is suggested:

- Confirm your organisation's usage of the relevant EU regulations and ICAO provisions - note any discrepancies.
- Identify any changes required in your operations.
- Identify any changes required from your operating partners.
- Document the change requirements.
- Invite your internal and where appropriate external partners to a joint meeting, using the aerodrome local Runway Safety Team to discuss the change requirement and possibly identify solutions.
- Conduct an appropriate safety assessment of the proposed change.
- Implement the change.
- Monitor the effectiveness of the change.

Changes to aerodrome operations may involve the introduction of new aerodrome infrastructure including visual aids, additional technologies or new ways to use the existing platform. Prior to making local changes that differ from EU/ICAO provisions, consideration should be given to the potential global effect on air traffic management. A considered approach to local change would be to create an operational evaluation period prior to permanent introduction of the desired operation. If you are satisfied with the outcome of the operational evaluation, consult your regulator to determine the overall effect on the air traffic management system prior to permanent introduction to operations.

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MEANING OF TERMS AND ACTION VERBS IN RECOMMENDATIONS AND GUIDANCE MATERIALS

"Shall"
is used in this document to signify that, while a recommendation does not have the force of a mandatory provision, its content has to be appropriately transposed at local level to ensure its application. (This is the case of an ANSP transposing into its Operations Manual the content of applicable recommendations in order to have controllers complying with them.)

"Should"
is used in this document to signify that the application of the recommendations would be beneficial to safety either as a 'best practice' or as a potential mandatory provision, after a local assessment.

"Assess"
is used in this document to indicate that you assess the current position/situation and decide if and how changes should be made to increase their effectiveness.

"Do Not"
as used in some Recommendations this document, is an imperative statement to signify that any recommendation and associated action must not be contradicted unless a local feasibility/safety assessment has been undertaken.

"Regulator"
is used in this document to refer not only to the organisation responsible for designing and making the regulatory framework progress, but also to the organisation that ensures that this regulatory framework is applied among the aviation undertakings it oversees. In some recommendations of this document, the term "regulator" refers also to the entity in charge of promoting safety among the aviation undertakings under its responsibility.

Aerodrome Flight Information Service Officers (AFISOs)
The Recommendations and Guidance Materials in this document that are applicable to air navigation service providers/air traffic controllers may also be relevant to AFISOs according to the local aerodrome context and the rules, regulations and practices and procedures that govern the provision of AFIS.

"H24"
means either full H24 operations (where aerodromes are open all day/night, or during published aerodrome operating hours when ATC is being provided (and not just in reduced visibility conditions and/or at night).

'Active' Runway
EASA GM1 ADR – DSN.M.745 states that "Active runway is to consider any runway or runways currently being used for take-off or landing. When multiple runways are used, they are all considered active runways."

Note:

Many of the EU Regulations listed in this document are supported by, and as necessary, should be read in conjunction with, EASA Certification Specifications (CS), Acceptable Means of Compliance (AMC) and Guidance Material (GM) which are intended to assist in the implementation of the relevant EU regulation.
These so-called "soft laws" can be accessed via:
https://www.easa.europa.eu/document-library/agency-rules-overview.

EUROPEAN ACTION PLAN FOR THE PREVENTION OF RUNWAY INCURSIONS

RECOMMENDATIONS

1.1 General principles

1.2 Aerodrome operator issues

1.3 Communications

1.4 Aircraft operator issues

1.5 Air navigation service provider issues

1.6 Data collection and lesson sharing

1.7 Regulators issues

1.8 Aeronautical information management

1.9 Technology

1.10 Civil military

2.0 Future work

1.1 GENERAL PRINCIPLES

#	Recommendation	Action	Guidance
1.1.1	Assess the implementation and operation of aerodrome local Runway Safety Teams (RST) and consider if and how changes could be made to increase their effectiveness in developing runway safety actions.	Aerodrome Operators, Air Navigation Service Provider, Aircraft Operators, Regulator.	Appendix B
1.1.2	Implement local runway safety awareness campaign plans and assess their effectiveness at each aerodrome for Air Traffic Controllers, Pilots and Vehicle Drivers and other personnel who operate on or near the runway. Consider format, method of delivery, frequency and feedback.	Aerodrome local Runway Safety Team.	Appendix B
1.1.3	Ensure that all infrastructure, practices and procedures relating to runway operations are in compliance with ICAO and, where applicable, EU provisions.	Aerodrome Operator (lead), Air Navigation Service Provider.	Appendix J Appendix K Appendix L
1.1.4	Promote and make available specific joint training and familiarisation in the prevention of runway incursions to Pilots, Air Traffic Controllers and Manoeuvring Area Vehicle Drivers.	Aerodrome local Runway Safety Team, Air Navigation Service Provider, Aircraft Operator, Regulator, Aerodrome Operator.	Appendix B
1.1.5	**a.** Assess how the subject of Runway Safety is included within initial and refresher/recurrent training for operational staff:	Aircraft Operator, Air Navigation Service Provider, Aerodrome Operator, Regulator, Training establishments.	
	b. Consider what more can be done to include the viewpoint and procedures of other stakeholders operating on the aerodrome.		
1.1.6	**a.** Ensure that adequate information is collected on all runway incursion incidents so that causal and contributory factors can be identified, lessons can be learned and actions taken.	Aircraft Operator, Air Navigation Service Provider, Aerodrome Operator, Aerodrome local Runway Safety Team, EUROCONTROL.	
	b. In addition, the salient points from investigation reports should be disseminated for Units, Organisations, and National and European stakeholders as information that may influence future safety improvement actions.		
1.1.7	Assess the arrangements currently in place that coordinate changes to manoeuvring area procedures, including works in progress. **Guidance Note**: This assessment should include the role of the aerodrome local Runway Safety Team in change management.	Air Navigation Service Provider, Aerodrome Operator, Regulator.	Appendix F Appendix L

#	Recommendation	Action	Guidance
1.1.8	**a.** Assess the implementation and effectiveness of Safety Management Systems related to runway safety activities.	Air Navigation Service Provider, Aerodrome Operator, Aircraft Operator, Regulator.	Appendix G
	b. Ensure a continued focus on runway safety in internal audit activities.		
1.1.9	Continue to develop components of SMS as detailed by ICAO, EU or EUROCONTROL (ESARR3) provisions that move towards a data driven, performance-based safety system approach with an emphasis on safety assurance and identifying and sharing best practice and signs of excellence.	Air Navigation Service Provider, Aerodrome Operator, Aircraft Operator, Regulator.	Appendix G
1.1.10	European stakeholders should work together to study the interpretation of the ICAO runway incursion definition with the aim of improving the consistency and credibility of runway incursion reporting via appropriate regulatory channels.	EUROCONTROL.	Appendix N

1.2 AERODROME OPERATOR

#	Recommendation	Action	Guidance
1.2.1	Assess the implementation of maintenance programmes relating to runway operations e.g. markings, lighting, signage in accordance with Commission Regulation (EU) No 139/2014 and ICAO Annex 14, Aerodromes, Volume 1 - Aerodrome Design and Operations when applicable. **a.** Ensure that signs, markings and lights are clearly visible, adequate and unambiguous in all appropriate conditions.	Aerodrome Operator.	Appendix B Appendix J
1.2.2	Assess all arrangements associated with aerodrome construction works/works in progress (WiP): **a.** Ensure that up to date information about temporary work areas and consequential operational impact is adequately presented and disseminated.	Aerodrome Operator, Air Navigation Service Provider, AIM Provider, Aircraft Operators.	Appendix H Appendix L
	b. Ensure that sufficient coordination between ANSPs and Aerodrome Operator is in place prior to notification to the Regulator.		Appendix H Appendix L
	c. Ensure that existing signs are covered and markings are removed when appropriate.		Appendix L
	d. Ensure that temporary signs and markings are clearly visible, adequate and unambiguous in all appropriate conditions.		Appendix L
	e. Aerodrome construction contractors and other personnel working airside should be appropriately briefed (about runway safety/runway incursion prevention) prior to starting work and be properly supervised whilst they are on the aerodrome.		
1.2.3	**a.** Assess formal Driver training and refresher programmes (including practical training and proficiency checks) against driver training guidelines e.g. the training programme framework at Appendix C.	Aerodrome Operator (lead), Air Navigation Service Provider (support).	Appendix C
	b. Carry out regular audits of airside driving permits (e.g. check 'recency' of use) in particular those allowing access to the runways, which should be as few as possible.		Appendix C

#	Recommendation	Action	Guidance
1.2.4	Assess formal RTF communications training and assessment for drivers and other personnel who operate on or near the runway.	Aerodrome Operator (lead), Air Navigation Service Provider (support).	Appendix C Appendix L
1.2.5	Assess the procedure for those occasions where manoeuvring area drivers become uncertain of their position on the manoeuvring area.	Aerodrome Operator(lead), Air Navigation Service Provider (support).	Appendix C
1.2.6	Promote the adoption of 'sterile cab' procedures to improve communications when on the manoeuvring area.	Aerodrome Operator(lead), Air Navigation Service Provider (support).	Appendix C
1.2.7	Assess the implementation of the ICAO standard naming convention for the manoeuvring area to eliminate ground navigation error and communication confusion.	Aerodrome Operator (lead), Air Navigation Service Provider (support).	Appendix K
1.2.8	**a.** Ensure all vehicles on the manoeuvring area are in radio contact with the appropriate Air Traffic Control service, i.e. ground and/or the tower either directly or through an escort	Regulator, Aerodrome Operator (lead), Air Navigation Service Provider (support).	Appendix A Appendix C
	b. Assess the numbering policy for aerodrome vehicles and consider assignment of unique numbers or airside identification call signs for each airside vehicle (to reduce the risk of vehicle related call sign confusion).		Appendix A Appendix C
1.2.9	Ensure all manoeuvring area vehicle drivers are briefed at the start of a shift.	Aerodrome Operator.	Appendix C Appendix L
1.2.10	Enable the tracking of vehicle movements on the manoeuvring area when possible.	Aerodrome Operator, Air Navigation Service Provider.	Appendix M
1.2.11	Aerodrome Operators, in conjunction with ANSPs, should review procedures for runway inspections. This should include: **a.** Carrying out runway inspections in the opposite direction to runway movements.	Aerodrome Operator, Air Navigation Service Provider, Regulator.	Appendix L
	b. Measures to ensure that uni-directional lighting is inspected effectively.		Appendix C
	c. Introducing procedures to increase situational awareness (of ATC and drivers) when vehicles occupy a runway (e.g. Vehicle 'Operations Normal' calls to ATC).		Appendix E
	d. Temporarily suspending operations to allow a full runway inspection to be carried out without interruption.		Appendix L

#	Recommendation	Action	Guidance
1.2.12	New aerodrome infrastructure and changes to existing infrastructure should be designed to reduce the likelihood of runway incursions.	Aerodrome Operator.	Appendix C Appendix E Appendix L
1.2.13	Working with ANSPs, avoid infringing lines of sight from the air traffic control tower: **a.** Assess visibility restrictions from the tower, which have a potential impact on the ability to see the manoeuvring area especially critical areas such as runway entry points.	Aerodrome Operator, Air Navigation Service Provider	Appendix E Appendix H
	b. Consider short term safety actions such as dissemination of this information as appropriate.		
	c. Identify longer term improvement where possible and develop appropriate mitigation, procedures, technology or re-positioning of the facility to ensure the best solution possible within the limitations of the airport layout.		
1.2.14	Regularly assess the operational use of aerodrome ground lighting e.g. stop bars, to ensure a robust policy to protect the runway from the incorrect presence of traffic: **a.** Safety studies have demonstrated that the use of H24 stop bars can be an effective RI prevention barrier. Therefore, Aerodrome Operator should, with ANSPs, consider the implementation of H24 stop bars at all runway holding points or other lighting systems providing an equivalent level of safety (e.g. Autonomous Runway Incursion Warning Systems (ARIWS)) at all runway holding positions.	Aerodrome Operator, Air Navigation Service Provider, Regulator.	Appendix E Appendix J
	b. Assess the need for elevated stop bars to improve stop bar conspicuity		Appendix E
	c. Consider use of LED technology to improve stop bar clarity.		
1.2.15	Aerodrome Operators, in cooperation with ANSPs, should implement procedures in line with Standardised European Rules of the Air (SERA) in case of stop bar unserviceability.	Aerodrome Operator, Air Navigation Service Provider.	Appendix E Appendix J

#	Recommendation	Action	Guidance
1.2.16	**a.** The design of closely spaced multiple parallel runway holding positons on the same taxiway should be avoided.	Aerodrome Operator	Appendix K
	b. Where a. above cannot be followed, the holding positions should be clearly segregated.		
1.2.17	**a.** Aerodrome Operators, in cooperation with ANSPs, should identify the Protected Area for each runway and produce an Aerodrome Protected Area chart/map.	Aerodrome Operator, Air Navigation Service Provider, Regulator.	Appendix C Appendix M
	b. Ensure that the Protected Area map is used in manoeuvring area driver training and is present in all vehicles that are driving on the manoeuvring area.		Appendix C Appendix L Appendix M

1.3 COMMUNICATIONS

#	Recommendation	Action	Guidance
1.3.1	**a.** To avoid the possibility of call sign confusion, implement the use of full aircraft or vehicle call signs for all communications concerning runway operations	Air Navigation Service Provider (lead), Aircraft Operator (lead), Aerodrome Operator (lead).	Appendix A Appendix E
	b. To avoid call sign confusion at aerodromes, implement the introduction of discrete RTF call signs to manoeuvring area vehicles.	Aerodrome Operator (lead), Air Navigation Service Provider (support).	Appendix E
1.3.2	Implement, monitor and ensure the use of standard phraseologies as applicable: EU: SERA Part C AMC ICAO: Doc. 4444, PANS-ATM	Air Navigation Service Provider (lead), Aircraft Operator (lead), Aerodrome Operator (lead).	Appendix A Appendix B Appendix E Appendix L
1.3.3	Implement, monitor and ensure the use of the readback procedure (also applicable to manoeuvring area drivers and other personnel who operate on the manoeuvring area).	Air Navigation Service Provider (lead), Aircraft Operator (lead), Aerodrome Operator (lead).	Appendix A Appendix C Appendix D Appendix E
1.3.4	Where practicable, improve situational awareness by conducting all communications associated with runway operations using aviation English.	Air Navigation Service Provider (lead), Aircraft Operator (lead), Aerodrome Operator (lead).	Appendix A Appendix C Appendix D Appendix E
1.3.5	When practicable, improve situational awareness, by implementing procedures whereby all communications associated with runway operations are on a common or cross-coupled frequency.	Air Navigation Service Provider (lead).	Appendix A Appendix C Appendix E
1.3.6	Consider regular evaluation of radio telephony practices, assessing elements such as frequency loading and use of EU/ICAO compliant phraseology.	Air Navigation Service Provider, Aircraft Operator, Aerodrome Operator.	Appendix A Appendix B Appendix E
1.3.7	If conditional clearances are used in accordance with ICAO provisions, ensure a policy and robust procedures are developed and implemented.	Air Navigation Service Provider.	Appendix A Appendix E
1.3.8	ANSPs and Aerodrome Operators should implement procedures that ensure significant aerodrome information which may affect operations on or near the runway, in addition to that found in NOTAMS and on the ATIS, should be provided to manoeuvring area drivers and pilots 'real-time' using radio communication.	Air Navigation Service Provider, Aircraft Operator, Aerodrome Operator.	Appendix C Appendix E Appendix H

1.4 AIRCRAFT OPERATOR

#	Recommendation	Action	Guidance
1.4.1	Provide training and assessment for pilots regarding Aerodrome signage, markings and lighting.	Aircraft Operator (lead).	Appendix D
1.4.2	Pilots shall not cross illuminated red stop bars when lining-up or crossing a runway (or on a taxiway where placed), unless contingency procedures are in force, e.g. to cover cases where the stop bars or controls are unserviceable.	Aircraft Operator.	Appendix A Appendix D Appendix J
1.4.3	Ensure that flight deck procedures contain a requirement for explicit clearances to cross any runway. **Guidance Note**: Includes non-active runways.	Aircraft Operator.	Appendix A
1.4.4	Flight Crew should not enter a runway for departure if not ready to take-off. Flight Crew must advise Air Traffic Control on first contact with the Tower if additional time on the runway is required for operational reasons.	Aircraft Operator, Air Navigation Service Provider.	Appendix D
1.4.5	If received significantly early, flight crew should confirm with ATC the line-up/take-off or crossing clearance when approaching the runway holding position.	Aircraft Operator, Air Navigation Service Provider.	Appendix D
1.4.6	Flight crew should consider confirming landing clearance on short final, if ATC issued it more than 5 nautical miles from touch down.	Aircraft Operator, Air Navigation Service Provider	Appendix D
1.4.7	Promote best practices in flight deck procedures while taxiing and during final approach - to include the "Sterile flight deck" concept.	IATA (lead), ECA/IFALPA (support).	Appendix D
1.4.8	Promote best practices for pilots' planning of ground operations.	IATA (lead), ECA/IFALPA (support).	Appendix D
1.4.9	Ensure a means to indicate receipt of landing / line-up / take off / crossing clearances in the cockpit.	Airframe Manufacturer, Aircraft Operator.	Appendix D
1.4.10	Pilots are advised to switch on forward facing lights when in receipt of a take-off clearance and show forward facing lights on the approach. **Guidance Note:** Global IFALPA policy	Aircraft Operator.	Appendix D
1.4.11	Pilots must be made aware of current safety significant airport information.	Aircraft Operator.	Appendix H
1.4.12	During taxi for departure or during approach, pilots should not accept a runway change proposal if time to re-programme the FMS / re-brief is not sufficient. This includes a change of departure intersection.	Aircraft Operator, Air Navigation Service Provider.	Appendix D

#	Recommendation	Action	Guidance
1.4.13	If Pilots have any doubt as to their exact position on the surface of an aerodrome, they should contact Air Traffic Control and follow the associated ICAO procedure (ICAO Doc. 4444, PANS-ATM).	Aircraft Operator.	Appendix D
1.4.14	A pilot should avoid being "head-down" to ensure a continuous external watch is maintained whilst taxiing.	Aircraft Operator.	Appendix D
1.4.15	If there is any doubt when receiving a clearance or instruction, clarification should be requested immediately from Air Traffic Control.	Aircraft Operator.	Appendix A Appendix D
1.4.16	Aerodrome charts or an equivalent electronic device should be displayed on the flight deck during taxi. This includes when operating at the home aerodrome.	Aircraft Operator.	Appendix D
1.4.17	Avoid accepting rapid exit taxiways or angled taxiways for line-up that limits the ability of the Flight crew to see the runway threshold or the final approach area.	Aircraft Operator.	Appendix D
1.4.18	Ensure that crews are aware of the significance of red lights (e.g. stop bars and other red lights) used in line with alerting systems to prevent incorrect entry onto a runway and to enhance situational awareness.	Aircraft Operator.	Appendix J
1.4.19	A pilot shall only apply Engine-Out–Taxi (EOT) procedure after careful consideration of local and operational circumstances so as to avoid a conflict with sterile cockpit procedures.	Aircraft Operator.	Appendix D

1.5 AIR NAVIGATION SERVICE PROVIDER

#	Recommendation	Action	Guidance
1.5.1	ANSPs shall ensure that runway safety issues are included in initial and refresher training and briefings for Air Traffic Control staff.	Air Navigation Service Provider.	Appendix E
1.5.2	ANSPs shall implement, update or highlight existing procedures that assist air traffic controllers, pilots and vehicle drivers to maintain good situational awareness. Procedures should also support pilots to maintain a sterile cockpit environment and maintain situational awareness whilst taxying or during critical stages of operation.` Actions include: **a.** Ensuring that Air Traffic Control communication messages are not overly long or complex.	Air Navigation Service Provider.	Appendix E
	b. Indicating the ultimate clearance limit (e.g. the runway holding position or intermediate holding position) and, in case of complex /overlong taxi route, use progressive taxi instructions to reduce pilot/vehicle driver workload and the potential for confusion.	Air Navigation Service Provider.	Appendix E
	c. It is strongly advised to develop and utilize standard taxi routes and clear standard route designators to minimise the potential for confusion, on or near the runway.	Air Navigation Service Provider.	Appendix E
	d. Whenever possible, pass en-route clearances prior to taxi and, in order to avoid distractions during taxi, consider the passing of revisions to en-route clearances whilst an aircraft is stopped.	Air Navigation Service Provider.	Appendix E
	e. When an aircraft is at a holding position or on the runway, ATC should always use the phrase: "HOLD POSITION" before passing a revised clearance.	Air Navigation Service Provider.	Appendix E
	f. Record and track vehicles entering the manoeuvring area through the use of vehicle progress strips.	Air Navigation Service Provider.	Appendix E
	g. When planning a runway change for departing or arriving traffic, consider the time a pilot will require to prepare/re-brief.	Air Navigation Service Provider.	Appendix E
	h. Issue line-up and/or take-off or crossing clearance only when the aircraft is at or approaching the runway holding position.	Air Navigation Service Provider.	Appendix E
	i. Do not issue a line-up clearance if the pilot has reported the aircraft is not ready to depart.	Air Navigation Service Provider.	Appendix E

#	Recommendation	Action	Guidance
	j. Do not issue a line-up clearance if the aircraft is expected to wait on the runway for more than 90 seconds before being able to issue the take-off clearance.	Air Navigation Service Provider.	Appendix E
	k. Do not use angled taxiways for entering the runway that limit the ability of the flight crew to see the runway threshold or the final approach area. **Guidance Note:** Consider to mandate the application in case of multiple or intersection departures.	Air Navigation Service Provider.	Appendix E
	l. Avoid issuing premature landing clearance.	Air Navigation Service Provider.	Appendix E
1.5.3	ANSPs should assess the current procedures regarding runway occupancy status and support the implementation of memory aids considering also the availability of new/emerging technologies.	Air Navigation Service Provider.	Appendix E
1.5.4	ANSPs should consider the implementation of emerging technology that can improve situational awareness and improve safety nets. This could include the implementation of enhanced A-SMGCS functionalities or alternative surveillance technologies.	Air Navigation Service Provider.	Appendix E Appendix N
1.5.5	ANSPs, in conjunction with the Aerodrome Operator, shall implement procedures for when an aircraft or vehicle becomes lost or uncertain of its position on the manoeuvring area. It is recommended that these procedures are reviewed and tested on a regular basis.	Air Navigation Service Provider.	Appendix C Appendix E Appendix L
1.5.6	ANSPs, in conjunction with the Aerodrome Operator, should regularly review procedures for runway inspections. This should include the evaluation of: **a.** Carrying out routine runway inspections in the opposite direction to runway movements.	Air Navigation Service Provider.	Appendix C Appendix E Appendix L
	b. Implementing procedures to increase overall situational awareness when vehicles occupy a runway (e.g. 'Vehicle Operation Normal' calls.	Air Navigation Service Provider.	Appendix C Appendix E Appendix L

#	Recommendation	Action	Guidance
1.5.7	Safety studies have demonstrated that the misapplication and misinterpretation of conditional clearances can be a contributing factor in runway incursions. Therefore ANSPs should: **a.** Assess conditional clearance operational procedures and practices.	Air Navigation Service Provider.	Appendix A Appendix E
	b. Consider if the operational use of conditional clearances can be reduced or removed at a specific aerodrome.	Air Navigation Service Provider.	Appendix A Appendix E
	c. Raise awareness to ATC staff about the correct use of conditional clearances and potential risks.	Air Navigation Service Provider.	Appendix E
1.5.8	ATC procedures shall contain a requirement to issue an explicit clearance, including the runway designator, when authorizing a runway entry, runway crossing or hold short of any runway. **Guidance Note:** Includes non-active runways.	Air Navigation Service Provider.	Appendix E Appendix N
1.5.9	ANSPs should review, on a regular basis, runway capacity enhancing procedures when used either individually or in combination (intersection departures, multiple line-up, conditional clearances etc.) to identify any potential hazards and, if necessary, develop appropriate mitigation strategies.	Air Navigation Service Provider.	Appendix B Appendix E
1.5.10	ANSPs should regularly assess the operational use of aerodrome ground lighting (e.g. stop bars, runway guard lights) in line with the applicable EU/ICAO provisions, to ensure a robust runway protection policy, and: **a.** Stop Bars at runway holding position must always be controlled by the controller in charge of the runway operations on that runway (Aerodrome controller).	Air Navigation Service Provider.	Appendix E Appendix J
	b. Safety studies have demonstrated that the use of H24 stop bars may be an effective RI prevention barrier. Therefore, considering local constraints and specificities, Aerodrome Operators should, with ANSPs, consider the implementation of H24 stop bars or other lighting systems providing an equivalent level of safety (e.g. ARIWS) at all runway holding positions.	Air Navigation Service Provider.	Appendix E Appendix J

#	Recommendation	Action	Guidance
	c. ANSPs, in cooperation with Aerodrome Operators, should implement procedures, in line with the applicable EU Regulations and associated AMC and GM in case of stop bar unserviceability.	Air Navigation Service Provider.	Appendix E Appendix J
	d. Aircraft or vehicles shall not be instructed to cross illuminated red stop bars unless contingency procedures are in force.	Air Navigation Service Provider.	Appendix E Appendix J
1.5.11	ANSPs should assess the sight lines from the Tower Visual Control Room (VCR) and existing visibility restrictions which have a potential impact on the ability to see the runway. Disseminate information as appropriate (e.g. include on appropriate AIP- A/D chart).	Air Navigation Service Provider.	Appendix E
1.5.12	In case of infringement of the Tower VCR sight lines, ANSPs should develop and implement short-term appropriate mitigations and identify longer term improvement, whenever possible.	Air Navigation Service Provider, Aerodrome Operator.	Appendix E Appendix K
1.5.13	**a.** ANSPs should regularly review Human Machine Interface (HMI) effectiveness. Controller Working Position (CWP) ergonomics and procedures shall promote and improve the controller 'visual scan' of the manoeuvring area in all weather conditions.	Air Navigation Service Provider, Aerodrome Operator.	Appendix E
	b. Air traffic controllers shall perform a visual scan of the entire runway and approach area in both directions before issuing a clearance to enter the runway or landing. This should primarily be by direct visual means, backed up by surveillance equipment in poor visibility situations.	Air Navigation Service Provider.	Appendix E
	c. ANSP shall develop procedures to ensure that, as far as practicable, controllers are "heads-up" for a continuous watch of aerodrome operations.	Air Navigation Service Provider.	Appendix E
	d. Air traffic controllers should pay attention to aircraft 'vacating' runways in particular where the exit taxiway may lead directly to another runway (crossing).	Air Navigation Service Provider.	Appendix E
1.5.14	ANSPs should apply and actively encourage Team Resource Management (TRM) principles in operations.	Air Navigation Service Provider.	Appendix E

1.6 DATA COLLECTION AND LESSON SHARING

#	Recommendation	Action	Guidance
1.6.1	Review and promote the implementation of occurrence reporting regimes and ensure their compatibility with ICAO, EU and national provisions.	Regulator, Air Navigation Service Provider, Aircraft Operators, Aerodrome Operators.	Appendix B
1.6.2	Disseminate de-identified information on actual runway incursions locally to increase understanding of causal and contributory factors to enhance lesson learning.	Regulator, Aerodrome Operator, Air Navigation Service Provider, Aircraft Operator.	Appendix B

Note:
See also General Principle Recommendations 1.1.6a, 1.1.6b and 1.1.9.

1.7 REGULATORS

#	Recommendation	Action	Guidance
1.7.1	Confirm that all infrastructure, practices and procedures relating to runway operations are in compliance with EU Regulations and, as applicable, any ICAO and/or national provisions.	Regulator.	Appendix J Appendix K Appendix L
1.7.2	Ensure the implementation of safety management systems is in accordance with EU Regulations and, as applicable, any ICAO and/or national standards.	Regulator.	Appendix G
1.7.3	Ensure that safety assurance documentation for operational systems (new and modified) demonstrates compliance with regulatory and safety management system requirements. .	Regulator.	Appendix G
1.7.4	Regulators should focus on runway safety in their oversight activities e.g. preventing runway incursion risks.	Regulator.	Appendix F
1.7.5	Ensure that Aerodrome Operators and Air Navigation Service Providers regularly review the operational use of aeronautical ground lighting e.g. stop bars, to ensure a robust policy to protect the runway from the incorrect presence of traffic. **Guidance Note:** Aircraft operators should also be invited to review to provide a wider perspective.	Air Navigation Service Provider, Aerodrome Operator, Aircraft Operator, Regulator.	Appendix E Appendix J
1.7.6	Ensure that the content of training materials for Pilots, Air Traffic Controllers and Drivers working on the manoeuvring area includes runway incursion prevention measures and awareness.	Regulator.	Appendix F
1.7.7	Ensure that environmental procedures e.g. noise mitigation rules take due account of runway safety. **Guidance Note:** Those noise mitigation elements that could potentially affect runway incursion/excursion risk include (but are not limited to): Airfield design and alignment based on noise consideration, noise preferred runway or runway operational mode, time-based runway selection to share noise load, runway specific curfews, arrival/departure curfews etc. which may (for example) require additional backtrack, runway crossings or other similar and otherwise avoidable risk.	Regulator.	Appendix B

#	Recommendation	Action	Guidance
1.7.8	Assess the performance of the change management process for procedural and/or infrastructural changes on the manoeuvring area.	Regulator.	Appendix G
1.7.9	National agencies charged with the oversight of aviation safety should consider how they discharge their responsibilities for runway safety which may include: **a.** The establishment and coordination of a national/state runway safety group that, inter alia, will address the prevention of runway incursions and runway collision risk.	Regulator.	Appendix B Appendix F
	b. Ensuring the prevention of runway incursions in national runway safety plans/State Safety Plans.		
	c. Supporting the state-wide promotion and coordinated implementation of EAPPRI v3.0.		
	d. Participating in aerodrome local Runway Safety Teams.		

1.8 AERONAUTICAL INFORMATION MANAGEMENT (AIM)

#	Recommendation	Action	Guidance
1.8.1	Ensure that the content of aeronautical information provided is in accordance with the ICAO standards and recommended practices and is up to date and relevant to the pilot. **a.** Information on aerodrome conditions should be simple to understand and focused on what is operationally necessary for the safety of flight, expressed in a standardised manner on format and content. Content should be minimized in volume as far as it does not compromise its efficiency and comprehensiveness.	Air Navigation Service Provider, Aeronautical Information Service Provider, Aerodrome operator, Regulator.	Appendix H
	b. Information on temporary changes to operating conditions at the aerodrome should be optimized to increase the situational awareness of the most critical changes. When needed, an AIP Supplement with graphics and charts should be published.		Appendix H
	c. For planned temporary changes, issuance of NOTAM with short notice ahead of the effective date or non-AIRAC publications should be avoided.		Appendix H Appendix L
1.8.2	Data (DAT) providers of aeronautical data, flight manuals and charts should establish a process with the Aeronautical Information Service Provider, with the objective of ensuring the accuracy, timeliness and integrity of the data.	Aeronautical Information Service Provider, Industry.	Appendix H
1.8.3	Ensure that the means and procedures are established at aerodromes for the collection of post-flight information and to allow users to provide feedback on the availability and quality of aeronautical information, in accordance with ICAO Annex 15 Aeronautical Information Services.	Aeronautical Information Service Provider, Aerodrome Operator, Aircraft Operator, EUROCONTROL.	Appendix H
1.8.4	The ergonomics of aeronautical maps and charts and relevant documentation should be improved to enhance their readability and usability, and be in accordance with relevant standards for aeronautical charts.	Air Navigation Service Provider, Aeronautical Information Service Provider, Aerodrome Operator, Aircraft Operator.	Appendix H
1.8.5	Move towards digital aeronautical information management to provide and use high quality aeronautical and aerodrome data in an interoperable exchange format.	Aerodrome Operator, Air Navigation Service Provider, Aeronautical Information Service Provider, Regulator, EUROCONTROL.	Appendix H
1.8.6	Aerodrome Operators and Aeronautical Information Service Providers should establish formal arrangements and assign responsibilities for maintaining direct and continuous liaison.	Air Navigation Service Provider, Aeronautical Information Service Provider, Aerodrome Operator, Regulator.	Appendix H

1.9 TECHNOLOGY

#	Recommendation	Action	Guidance
1.9.1	Improve situational awareness by adopting the use of technologies that enable operational staff on the manoeuvring area to confirm their location in relation to the runway e.g. via GPS with transponder or airport moving maps, visual aids, signs etc.	Aerodrome Operator, Air Navigation Service Provider, Aircraft Operator.	Appendix M
1.9.2	Promote the integration of safety nets to provide immediate and simultaneous runway and traffic proximity alerts for pilots, air traffic controllers and manoeuvring area vehicle drivers.	EUROCONTROL, SESAR.	Appendix M

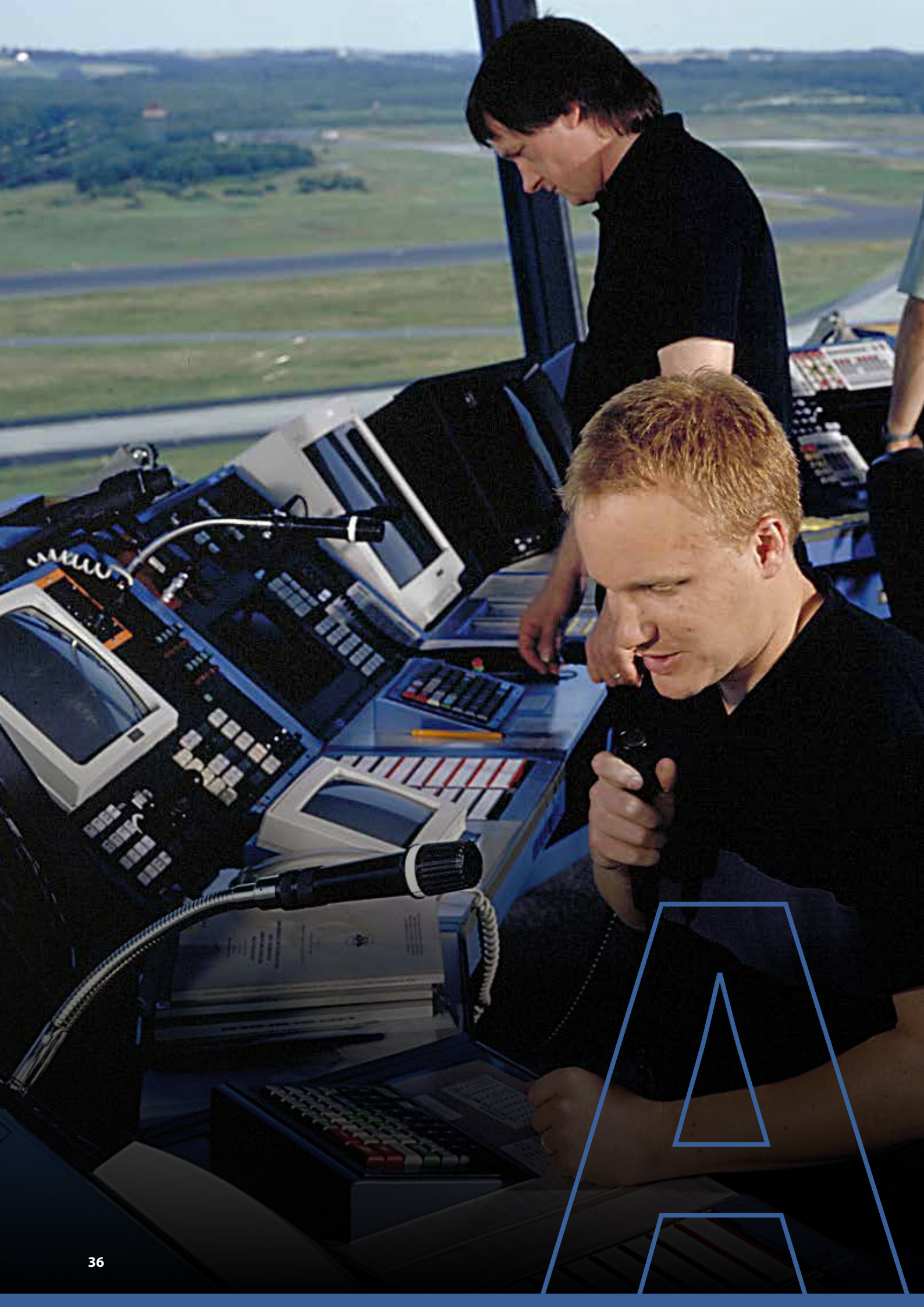
1.10 CIVIL MILITARY

#	Recommendation	Action	Guidance
1.10.1	Where more than one aerodrome operator exists at a joint-use aerodrome, a leading aerodrome operator should be identified to secure a harmonised, consistent and coordinated application of the recommendations for the prevention of runway incursions.	Military Aviation Authority,Regulator.	Appendix I
1.10.2	New investment or reconstruction work on the manoeuvring area should be planned, coordinated and safety assessed between civil and military entities, in consultation with the aerodrome local Runway Safety Team.	Military Aviation Authority, Regulator, Aerodrome Owner/ Operator, Air Navigation Service Provider, aAerodrome local Runway Safety Team.	Appendix B Appendix I
1.10.3	Differences in application of Civil and Military traffic procedures that can affect operational safety should be published in accordance with ICAO Annex 15, Aeronautical Information Services.	Aerodrome Operator, Air Navigation Service Provider, Aeronautical Information Service Provider, Military Aviation Authority, Regulator.	Appendix I
1.10.4	Coordinate civil and military inspection/audit activities and subsequent safety recommendations with civil and military authorities.	Regulator, Military Aviation Authority.	Appendix F Appendix I
1.10.5	Timely planning and coordination of aerodrome operations between civil and military aerodrome entities should be established as appropriate.	Aerodrome Operator.	Appendix I
1.10.6	Standard ICAO phraseology should be in use during civil operations at joint use aerodromes.	Air Navigation Service Provider, Aircraft Operator.	Appendix A Appendix E Appendix I
1.10.7	When practicable, procedures to use VHF frequency for communications or cross coupled UHF/VHF associated with runway operations should be developed for civil and military traffic operating simultaneously. The objective is to maintain the required level of situational awareness with civil and military pilots, manoeuvring area vehicle drivers and air traffic controllers.	Air Navigation Service Provider, Aerodrome Operator.	Appendix A Appendix D Appendix E Appendix I
1.10.8	On the manoeuvring area, a formation of military aircraft should be treated as one entity and never split.	Air Navigation Service Provider, Aircraft Operator.	Appendix I
1.10.9	Conditional clearances should not be used for civilian traffic during military formation flight operations.	Air Navigation Service Provider.	Appendix A Appendix I
1.10.10	Standard ICAO Annex 14 –Aerodromes, Volume 1 - Aerodrome Design and Operations aerodrome signs, lights and markings should be used where civil and military share a manoeuvring area.	Aerodrome Operator.	Appendix A Appendix I

#	Recommendation	Action	Guidance
1.10.11	Wherever practicable, military aircraft should use on-board lights in accordance with ICAO Annex 2, Rules of the Air. **a.** If required, additional procedures should be applied to maintain the required level of situational awareness at joint-use aerodromes.	Aerodrome Operator.	Appendix A Appendix D Appendix I
1.10.12	Ensure that military pilots and manoeuvring area vehicle drivers who are temporarily deployed at civil aerodromes are competent to operate within the remit of ICAO provisions and local procedures.	Military Aviation Authority, Regulator, Aerodrome Operator, Aircraft Operator.	Appendix A Appendix C Appendix F Appendix I
1.10.13	EAPPRI recommendations on infrastructure should be implemented at civil/military joint-use aerodrome at least where civil aircraft operations are permitted.	Military Aviation Authority, Regulator, Aerodrome Operator, Aircraft Operator.	Appendix J Appendix K

2 FUTURE WORK

#	Recommendation	Action	Guidance
2.1.1	Information about the development of new technologies that can be applied to runway safety shall be disseminated as part of the general runway safety awareness campaign.	European regulatory bodies in coordination with Industry.	Appendix C
2.1.2	Identify any ICAO guidance material that should be upgraded to ICAO standards and recommended practices and review other relevant materials.	EUROCONTROL Safety Improvement Sub Group (Runway Safety)	
2.1.3	Monitor and evaluate emerging technologies that may affect future aerodrome operations. Consider potential implications concerning runway safety and provide appropriate guidance: **a.** Remote Tower technologies.	EUROCONTROL Safety Improvement Sub Group (Runway Safety).	Appendix M
	b. Authorised Remotely Piloted Aircraft Systems (RPAS)/'drone' and autonomous vehicle operations on and around the aerodrome.		
2.1.4	Coordinate with other national and regional runway incursion prevention activities.	EUROCONTROL Safety Improvement Sub Group (Runway Safety).	Appendix M



APPENDIX A
COMMUNICATIONS GUIDANCE

Introduction

Factors affecting communication breakdown

Loss of communication and runway incursions

Aviation language for international services

Runway Frequency

Aerodrome Control Phraseologies

Aerodrome Control Phraseology – READBACK

Avoiding Call Sign Confusion

Communication techniques - general

What to do if uncertain of your position on the manoeuvring area

Conditional Clearance

Improving communications for little or no cost

APPENDIX A COMMUNICATIONS GUIDANCE

INTRODUCTION

The demanding environment associated with aerodrome operations on a runway requires that **all participants** accurately receive, understand, and correctly **read back all air traffic control clearances and instructions**. All access to a runway (even if non-active) should take place only after a positive ATC clearance has been given / received and a correct readback has been provided / accepted, and after the stop bar (where provided) has been switched off; providing a clearance in a timely manner, as the aircraft is approaching the relevant runway, will help to prevent runway incursions. This appendix offers guidance materials built upon Best Practices from European aerodromes that may help to protect the integrity of voice communications for operational staff working on the manoeuvring area.

FACTORS AFFECTING COMMUNICATION BREAKDOWN

From studies of investigation reports, and from reports/ surveys regarding runway safety occurrences, it is apparent that communications issues are frequently a causal or contributory factor.

Examples of factors leading to communication breakdown on the manoeuvring area include, but are not limited to:

- Complex instructions to different aircraft.
- Controller/pilot/driver high speech rate.
- Two different languages being used.
- Frequency congestion / blocked frequency.
- Use of non-standard EU/ICAO phraseology.
- Call sign confusion.
- Absent, poor or incomplete readback.
- Incomplete or ambiguous clearances.
- Inadequate aviation English.
- Heavily accented English.
- Different frequencies associated with runway operations.
- Inadequate driver communication training.

LOSS OF COMMUNICATION AND RUNWAY INCURSIONS

Entering a runway (to line up or cross) or landing without a valid ATC clearance will lead to the incorrect presence of traffic on a runway and require a runway incursion to be reported. Pilots should squawk 7600 in VMC or IMC to advise loss of communication on the manoeuvring area.

Be aware that when communication is lost on the approach most pilots will land without a clearance. Pilots should squawk 7600 in VMC or IMC to advise loss of communication.

ICAO Doc. **4444 PANS-ATM AIR-GROUND COMMUNICATIONS FAILURE**

Note 2. *"An aircraft equipped with an SSR transponder is expected to operate the transponder on Mode A Code 7600 to indicate that it has experienced air-ground communication failure. An aircraft equipped with other surveillance system transmitters, including ADS-B and ADS-C, might indicate the loss of air-ground communication by all of the available means."*

AVIATION LANGUAGE FOR INTERNATIONAL SERVICES

Use of Aviation English is proven to be a significant factor in the establishment and maintenance of situational awareness for all participants associated with runway operations.

ICAO Annex 1

"As of 5 March 2008, aeroplane, airship, helicopter and powered-lift pilots, air traffic controllers and aeronautical station operators shall demonstrate the ability to speak and understand the language used for radiotelephony communications to the level specified in the language proficiency requirements in Appendix 1."

APPENDIX 1

REQUIREMENTS FOR PROFICIENCY IN LANGUAGES USED FOR RADIOTELEPHONY COMMUNICATIONS.

1. General

Note - *The ICAO language proficiency requirements include the holistic descriptors at Section 2 and the ICAO Operational Level (Level 4) of the ICAO Language Proficiency Rating Scale in Attachment A. The language proficiency requirements are applicable to the use of both phraseologies and plain language.*

2. Holistic descriptors

Proficient speakers shall:

a) communicate effectively in voice-only (telephone radiotelephone) and in face-to-face situations;

b) communicate on common, concrete and work-related topics with accuracy and clarity;

c) use appropriate communicative strategies to exchange messages and to recognise and resolve misunderstandings (e.g. to check, confirm, or clarify information) in a general or work-related context;

d) handle successfully and with relative ease the linguistic challenges presented by a complication or unexpected turn of events that occurs within the context of a routine work situation or communicative task with which they are otherwise familiar; and

e) use a dialect or accent which is intelligible to the aeronautical community."

ICAO Annex 10, Aeronautical Communications, Language to be used

"The air-ground radiotelephony communications shall be conducted in the language normally used by the station on the ground or in the English language. ICAO Doc. 9432 Manual Radio Telephony."

***Note** - Commission Implementing Regulation (EU) No 2016/1185 also says that "air-ground radio telephony communications shall be conducted in English or in the language normally used by the ground station". In exceptional cases, however, it also provides EASA Member States with a potential opt out from this requirement subject to a safety assessment and notification to the Commission. Notwithstanding this, see SERA AMC/GM 14015, EAPPRI Recommendation 1.3.4 and below provide further information regarding the frequencies and language to be used for runway operations*

RUNWAY FREQUENCY

It is recommended that communications for all operations on a runway (landing, departing, crossing aircraft, vehicles crossing and runway inspections etc.) take place on the VHF frequency assigned for that runway; this will help to maintain high levels of situational awareness. To accommodate vehicles that are equipped with UHF radios only, 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). When using RTF frequency coupling, Controllers (and drivers) need to be mindful of 'clipped' transmissions, where the beginning or end of the transmission is not broadcast/received.

Concerns about runway frequency congestion due to drivers using VHF can be alleviated by treating every use of the runway as a planned traffic movement, and keeping detailed discussions e.g. FOD descriptions, for another frequency.

Some aerodromes (e.g. Brussels Airport) have taken the principles described above further and have introduced the concept known as "Triple One": One Runway, One Frequency, One Language (English) as a means to further improve communications/situational awareness for all operations on a runway.

***Note:** Aerodromes with multiple runways may use a different frequency for each runway.*

AERODROME CONTROL PHRASEOLOGIES

Use of established **standard EU and ICAO phraseologies** for radio telephony communication between aircraft and ground stations is essential to avoid misunderstanding, and to reduce the time required for communication. EU/ICAO phraseology shall be used in all situations for which it has been specified. When standardised phraseology for a particular situation has not been specified, plain language shall be used. EU SERA (AMC of SERA 14001) and ICAO Annex 10 Volume II, Aeronautical Telecommunications both state this requirement is as follows:

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

All personnel involved in operations associated with runways must use clear, concise and unambiguous phraseologies. Such usage will ensure that safety levels are maintained or improved upon.

ICAO Doc. 9432 Manual of Radiotelephony says:

"In the Doc. 4444 PANS-ATM, it is further emphasized that the phraseologies contained therein are not intended to be exhaustive, and when circumstances differ, pilots, ATS personnel and other ground personnel will be expected to use appropriate subsidiary phraseologies which should be as clear and concise as possible and ***designed to avoid possible confusio****n by those persons using a language other than one of their national languages. "Appropriate subsidiary phraseologies" can either refer to the use of plain language,* ***or the use of regionally or locally adopted phraseologies****. Either should be used in the same manner in which phraseologies are used: clearly, concisely, and unambiguously. Additionally, such* ***appropriate subsidiary phraseologies should not be used instead of ICAO phraseologies, but in addition to ICAO phraseologies when required,*** *and users should keep in mind that many speakers/listeners will be using English as a second or foreign language."*

All personnel involved in operations associated with runways must use clear, concise and unambiguous phraseologies. Such usage will ensure that safety levels are maintained or improved upon.

Example Phraseologies

Listed below are some of the relevant key ICAO phraseologies contained within those documents, applicable for operations on runways. More examples of the application of phraseologies may be found in ICAO Doc. 9432, Manual of Radiotelephony and Doc. 4444, PANS -ATM. It should be noted that these phraseologies are for use by air traffic controllers, pilots, and when applicable, vehicle drivers.

Special note for vehicle drivers

ICAO Doc. 4444, PANS-ATM phraseologies for the movement of vehicles, other than tow-tractors, on the manoeuvring area shall be the same as those used for the movement of aircraft, with the exception of taxi instructions, in which case the word "**PROCEED**" shall be substituted for the word "**TAXI**" when communicating with vehicles.

The procedure contained in ICAO Doc. 4444, PANS-ATM 12.2.7 makes no provision for vehicles to be included in the process of receiving a **conditional clearance**; they may only be the subject of a conditional clearance.

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 ICAO Doc. 4444, PANS-ATM where a complete listing is available in Chapter 12. They refer to those elements considered crucial to runway safety aspects.*

A. TAXI PROCEDURES

For departure

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

Or where detailed taxi instructions are required

ATC (call sign) TAXI TO HOLDING POINT [number] RUNWAY (number) HOLD SHORT OF RUNWAY (number) [contact TWR]

ATC (or CROSS RUNWAY (number)) TIME (time);

It should be noted that the words "***position … and / or hold***" may be misunderstood by some pilots due to the use of non ICAO phraseology within North America, where "taxi into position and hold…" is used by ATC when issuing a line up clearance. There have been a number of runway safety occurrences with the key words 'position' and 'hold' misapplied, therefore read-backs should be very carefully monitored when using these words. See also, Holding instructions from ATC below.

ATC (call sign) TAXI VIA RUNWAY (number);

PILOT (call sign) REQUEST BACKTRACK

ATC (call sign) BACKTRACK APPROVED

ATC (call sign) BACKTRACK RUNWAY (number);

Other general instructions

Caution should be exercised when using the phrase 'follow', at or near runway holding points as pilots and drivers have been known to interpret this as clearance to continue following traffic as it enters or lines-up on a runway.

ATC (call sign) VACATE RUNWAY

PILOT/DRIVER (call sign) RUNWAY VACATED

The Pilot or Driver may not always be sure if they are clear of the ILS sensitive area. Don't assume runway vacated means no runway re-entry for some aerodrome layouts.

ATC (call sign) EXPEDITE TAXI (reason)

PILOT/DRIVER (call sign) EXPEDITING

ATC (call sign) TAXI SLOWER (reason)

PILOT/DRIVER (call sign) SLOWING DOWN

B. HOLDING INSTRUCTIONS FROM ATC

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

ATC (call sign) HOLD POSITION;

ATC (call sign) HOLD (distance) FROM (position)

… to hold not closer to a runway than specified in ICAO Doc. 4444, PANS-ATM ,Chapter 7, 7.6.3.1.3.1

ATC (call sign) HOLD SHORT OF (position);

READBACK FROM PILOTS/DRIVERS
(call sign) HOLDING;
(call sign) HOLDING SHORT.

It should be noted that aircraft should not hold closer to a runway than specified in ICAO Doc. 4444, Chapter 7, 7.6.3.1.3.1.

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

C. 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 (night, low visibility, etc.), the instruction should always be accompanied by a request to report when the aircraft or vehicle has vacated the runway.*

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

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

Note *- The pilot or driver will, when requested, report "RUNWAY VACATED" when the aircraft or vehicle is clear of the runway.*

D. PREPARATION FOR TAKE-OFF -CLEARANCE TO ENTER RUNWAY AND AWAIT TAKE-OFF CLEARANCE.

ATC (call sign) LINE UP [AND WAIT];

ATC (call sign) LINE UP RUNWAY (number);

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

Good practice read back example

Pilot (call sign) from S3 line up runway 27 and wait

Proposing 'be ready for immediate departure' or asking the question 'are you ready for immediate departure?' does not imply a take-off clearance has been given.

The phrase 'Go ahead' (meaning pass your message) may be misinterpreted as an instruction to move the vehicle or aircraft and should therefore NOT be used.

E. 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 contained in ICAO Doc. 7030. In addition to the standard phraseology in Chapter 12 of PANS-ATM the following ATC phraseology shall be used:

ATC (call sign) LINE UP AND WAIT RUNWAY 22, INTERSECTION ALPHA ONE, NUMBER 2 FOR DEPARTURE, NUMBER ONE AN AIR FRANCE B737 DEPARTING FROM INTERSECTION BRAVO.

PILOT LINING UP AND WAIT RUNWAY 22, INTERSECTION ALPHA ONE, NUMBER 2, (call sign)

F. CONDITIONAL CLEARANCES

ICAO Doc. 4444, PANS-ATM 12.2.7 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. The aircraft or vehicle causing the condition in the clearance issued shall be the first aircraft/vehicle to pass in front of the other aircraft concerned. In all cases a conditional clearance shall be given in the following order and consist of:

a) identification;
b) the condition;
c) the clearance; and
d) brief reiteration of the condition,

For example:

ATC "(call sign), BEHIND DC9 ON SHORT FINAL, LINE **UP BEHIND".**

Note *- This makes explicit the need for the aircraft receiving the conditional clearance to identify the aircraft or vehicle causing the conditional clearance.*

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 call sign.**

ATC **(call sign) [that is] correct**

Note*: The procedure also makes no provision for vehicles to be included in the process of receiving a conditional clearance. They may only be the subject of a conditional clearance.*

G. TAKE-OFF CLEARANCE

ATC (call sign) CLEARED FOR TAKE-OFF [REPORT AIRBORNE]…. Applicable for Low Visibility operations;

Best Practice to prevent wrong runway selection, or when more than one runway in use, always use the runway designator in the instruction,

ATC (call sign) RUNWAY (number) CLEARED FOR TAKE-OFF

When take-off clearance has not been complied with,

ATC (call sign) TAKE OFF IMMEDIATELY OR VACATE RUNWAY [(instructions)];

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

Or to cancel a take-off clearance

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

PILOT (call sign) HOLDING;

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

ATC (call sign) STOP IMMEDIATELY [(repeat aircraft call sign) STOP IMMEDIATELY]

PILOT (call sign) STOPPING;

AERODROME CONTROL PHRASEOLOGY – READBACK

Of equal importance to the usage of correct phraseologies is the need to obtain the required readback, in the order required and accurately. 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.

In ICAO Doc.4444 PANS-ATM the requirements regarding readbacks are as follows:

"Read-back of clearances and safety-related information

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

a) ATC route clearances;

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

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

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

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

Studies of air ground communication practices have shown that incomplete readbacks may mask a misunderstanding. Incorrect readbacks show there is a misunderstanding. Air traffic control must challenge incomplete or incorrect readbacks."

AVOIDING CALL SIGN CONFUSION

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 for runway operations. Whilst the ICAO provisions allow for use of abbreviated call signs in certain circumstances, it is deemed Best Practice not to apply any shortening of call signs in this situation.

Call sign confusion is not restricted to similar call signs between aircraft. Confusion may occur between aircraft and vehicle call signs. Confusion with infrastructure may also be part of call sign confusion incidents.

Runway Incursion Example:

RJ 85 is on final to land RWY 02. Meanwhile, an aircraft with the call sign "Delta xxx" has to taxi to a position called "Delta 2" later split in "Delta 2-2. RWY 02 (RWY 2 for US pilots) is in use.

ATC to outbound taxiing traffic:
"**DELTA XXX CROSS RUNWAY ZERO SEVEN RIGHT AND CONTINUE STRAIGHT AHEAD TO DELTA TWO (a taxiway)**"

Pilot Delta xxx:
"**CROSS RUNWAY SEVEN RIGHT TO RUNWAY TWO" (unchallenged incorrect readback)**

ATC:
"DELTA XXX TAKE POSITION ON DELTA TWO PLEASE" (non EU/ICAO phraseology)

Pilot Delta xxx
"AFFIRM ON DELTA TWO TWO "

ATC to landing traffic:
"RJ85 GO AROUND, I SAY AGAIN GO AROUND TRAFFIC TOO CLOSE TO THE RUNWAY"

Pilot 85
"GOING AROUND RJ85"

Pilot of Delta interpreted these instructions as Delta to (runway) 02.

ICAO DOC. 4444, PANS-ATM

- TRANSMISSION OF NUMBERS

  - RWY = each digit separately
  - i.e. RWY02 = RUNWAY ZERO TWO – RUNWAY TWO

- TAXI PROCEDURES

  - TAXI TO HOLDING POINT RWY # #
    HOLD SHORT OF RWY # #
    (was not said by the controller)

- PREPARATION FOR T/O

  - CLEARANCE TO ENTER A RWY MUST BE OBTAINED:
  - LINE UP (AND WAIT) RWY # #

Other points of confusion include **aircraft type misidentification and aircraft livery confusion** where the livery is not representative of the aircraft call sign.

To mitigate against potential call sign confusion between vehicles operating on the aerodrome, some airports have introduced vehicle numbering schemes (e.g. block numbers or unique/discrete identifying numbers) to help differentiate call signs for vehicles.

COMMUNICATION TECHNIQUES - GENERAL

Detailed below are the relevant provisions laid down in Annex 10, Aeronautical Communications with regard to radio transmission guidelines and techniques.

Speech-transmitting techniques should be such that the highest possible intelligibility is incorporated in each transmission. Fulfilment of this aim requires that flight crew and ground personnel should:

a) Enunciate each word clearly and distinctly;

b) Maintain an even rate of speech. When a message is transmitted to an aircraft and its contents need to be recorded the speaking rate should be at a slower rate to allow for the writing process. A slight pause preceding and following numerals makes them easier to understand;

c) Maintain the speaking volume at a constant level;

d) Be familiar with the microphone operating techniques particularly in relation to the maintenance of a constant distance from the microphone if a modulator with a constant level is not used;

e) Suspend speech temporarily if it becomes necessary to turn the head away from the microphone.

WHAT TO DO IF UNCERTAIN OF YOUR POSITION ON THE MANOEUVRING AREA

Pilots and airside manoeuvring area drivers do not knowingly enter a runway without a valid ATC clearance. When this happens, it is most likely because the pilot or driver is uncertain of their position and situational awareness has been lost. ICAO has developed a procedure about what to do if you are a pilot, driver or air traffic controller with a team member who does not know that they are on a runway or taxiway.

ICAO Doc. 4444 PANS-ATM - "UNCERTAINTY OF POSITION ON THE MANOEUVRING AREA

Except when a pilot is in doubt as to the position of the aircraft with respect to the manoeuvring area shall immediately:

a) stop the aircraft; and

b) simultaneously notify the appropriate ATS unit of the circumstances (including the last known position).

In those situations where a pilot is in doubt as to the position of the aircraft with respect to the manoeuvring area, but recognizes that the aircraft is on a runway, the pilot shall immediately:

a) notify the appropriate ATS unit of the circumstances (including the last known position);

b) if able to locate a nearby suitable taxiway, vacate the runway as expeditiously as possible, unless otherwise instructed by the ATS unit; and then,

c) stop the aircraft.

A vehicle driver in doubt as to the position of the vehicle with respect to the manoeuvring area shall immediately:

a) notify the appropriate ATS unit of the circumstances (including the last known position);

b) simultaneously, unless otherwise instructed by the ATS unit, vacate the landing area, taxiway, or other part of the manoeuvring area, to a safe distance as expeditiously as possible; and then,

c) stop the vehicle.

7.4.1.5.4 In the event the aerodrome controller becomes aware of an aircraft or vehicle that is lost or uncertain of its position on the manoeuvring area, appropriate action shall be taken immediately to safeguard operations and assist the aircraft or vehicle concerned to determine its position."

CONDITIONAL CLEARANCES

Safety studies have demonstrated that the misapplication and misinterpretation of conditional clearances can be a contributing factor in runway incursions.

As per Recommendation 1.3.7, if conditional clearances are used, in accordance with ICAO provisions, ANSPs should ensure a policy and robust procedures are developed and implemented. Moreover, ANSPs should:

- Assess conditional clearance operational procedures and practices. There should be a clear operational justification for the use of conditional clearances, i.e. to help improve the flow and throughput of traffic. Conditional clearances should not be used for the convenience of the controller and/or pilot when there is no operational requirement. Strict observations of conditional clearance conditions by controllers should be monitored as part of routine operational supervision and ongoing competency assessments.

- Consider if the operational use of conditional clearances can be removed or reduced at specific aerodromes where their use cannot be justified for capacity enhancement or traffic throughput purposes.

Note: *To raise awareness of the importance of the correct application of conditional clearances a SKYbrary SKYclip has been produced which can be viewed at*

http://www.skybrary.aero/index.php/Conditional_Clearance_(SKYclip)

IMPROVING COMMUNICATIONS FOR LITTLE OR NO COST

- Introduce a method for self-checking if EU/ICAO compliant phraseology is used for air traffic controllers e.g. by taking the opportunity to listen to short samples of own R/T and comparing what was said with EU/ICAO phrases on a regular basis.

  Note: An example 'best practice' form can be seen on SKYbrary at https://skybrary.aero/bookshelf/books/4081.pdf

- Ensure a cockpit friendly method to record line-up / crossing clearances is available.

- Implement a method for manoeuvring area drivers to record when a clearance to enter or cross a runway is received.

- ATC clearances must be issued early enough to ensure that they are transmitted to the aircraft in sufficient time for pilots to comply with them.

- Raise awareness that EU/ICAO compliant communication practices help to prevent ground navigation errors.

- One best practice is to implement a systematic evaluation of the R/T loading; it may lead to frequency splitting.

- Consider training recommendations for pilots, controllers and vehicle drivers, including practical exams.

B

APPENDIX B
GUIDELINES FOR AERODROME LOCAL RUNWAY SAFETY TEAMS

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APPENDIX B GUIDELINES FOR AERODROME LOCAL RUNWAY SAFETY TEAMS

INTRODUCTION

An aerodrome local Runway Safety Team (RST) should form a key element in the aerodrome runway safety programme and should ensure that a strong focus is maintained on runway safety across all parties creating, de facto, an aerodrome level safety management function. At some aerodromes cross-disciplinary teams may already exist that could carry out the functions of the aerodrome local Runway Safety Team, using a discrete runway safety agenda. If such teams are employed it is essential that their work is not duplicated; instead the work should be integrated as part of the aerodrome's runway safety action plan.

ESTABLISHING A AERODROME LOCAL RUNWAY SAFETY TEAM

Aerodrome local Runway Safety Teams have been established at many aerodromes in Europe. Experience has demonstrated that these teams have been effective at helping to minimise the risk of runway incursions at individual aerodromes, where local issues such as taxiway layout, runway configuration and aircraft operators' needs can be taken into account.

Note: *Once established the aerodrome local Runway Safety Team can be registered with ICAO at:*

https://www.icao.int/safety/RunwaySafety/Pages/default.aspx

ROLE

The role of the aerodrome local Runway Safety Team should be to advise the appropriate Management on the potential runway safety issues and to recommend mitigating measures and solutions for those identified issues. This appendix provides guidance on the role of that team.

TERMS OF REFERENCE

The tasks mentioned here may be reflected in the suggested Terms of Reference for an aerodrome local Runway Safety Team.

- Monitor the number, type and, the severity of runway safety events;
- identify any local problem areas and suggest improvements e.g. by sharing the outcome of investigation reports to establish local hot spots or problem areas at the aerodrome and workable mitigations with and for operational staff;
- work as a cohesive team to better understand the operating difficulties of personnel who work in other areas and recommend areas for improvement;
- ensure that the recommendations contained in this European Action Plan for the Prevention of Runway Incursions are implemented;
- conduct a runway safety awareness campaign that focuses on local issues, e.g. produce and distribute local hot spot maps or other guidance material as considered necessary; and
- review the aerodrome to ensure it is adequate and compliant with ICAO and, where applicable, EU Standards and Recommended Practices regularly.

The establishment of an aerodrome local Runway Safety Team is intended to facilitate effective local implementation of the recommendations contained in the European Action Plan for the Prevention of Runway Incursions and to stimulate proactive management of runway safety.

Specific objectives of an aerodrome local Runway Safety Team include development of appropriate runway incursion risk prevention measures and creation of awareness of potential solutions, advising Management on runway safety issues and recommending mitigation measures. A plan containing action items for mitigating runway safety deficiencies should be developed. Action items should be aerodrome specific and linked to a runway safety concern, issue or problem at that aerodrome.

COMPOSITION

The team should consist of, as a minimum, representatives from at least the main groups associated with manoeuvring area operations, namely the Aerodrome Operator (which would include a vehicle driver), Ground Handling Associations when appropriate, representatives from the Air Navigation Service Provider/and local Air Traffic Controller associations and pilots from Aircraft Operators/and local pilot associations that operate at the aerodrome and other organisations (e.g. wildlife control) that operate on the manoeuvring area. Regulators may also be invited to attend to advise on regulatory matters.

Notes:

1. *The ICAO Runway Safety Team Handbook (Edition 2, June 2015) and Commission Regulation (EU) No 139/2014 describe the establishment, role, composition and ToR of aerodrome local Runway Safety Teams.*

2. *The ICAO RST Handbook also encourages the presence of the regulatory authority to attend local RST meetings and lists technical experts of controller and pilot associations as representatives who should participate.*

3. *ICAO has introduced the concept of Runway Safety Team 'Go-Teams' which aim 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; details are in the ICAO RST Handbook.*

ICAO AND EU

ICAO Standards and recommended practices (SARPs) are available to give the same consistent, predictable operations at any aerodrome in the world. For EU states, EU Regulations and associated AMC/GM transpose applicable ICAO SARPs and some differences from them, into EU law.

All available safety recommendations of global interest to the civil aviation community, resulting from runway related accidents and incidents and their successful risk mitigations should be reported to ICAO using the normal reporting mechanism for the relevant organisations, i.e. the organisations involved in the incursion. In EU states, reporting must also comply with Commission Regulation (EU) No 376/2014 and its supporting implementing regulations.

ICAO RUNWAY INCURSION DEFINITION

To enable the sharing of safety lessons learned and a common understanding of runway incursion causal and contributory factors, ICAO introduced a commonly agreed definition of a runway incursion in November 2004. The definition is:

"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: *This definition is also adopted in Commission Regulation (EU) No 139/2014 Guidance Material.*

One role of the aerodrome local Runway Safety Team is to ensure that the ICAO definition is used. It is apparent, however, that there are still various different interpretations of the definition and the new Appendix N looks at this in more detail with the aim of providing information that could lead to a more consistent application of the runway incursion definition.

ICAO HOT SPOT DEFINITION

The ICAO definition of a hot spot is:

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

The criteria used to establish and chart a hot spot are contained in the ICAO Doc. 9870, Manual for the Prevention of Runway Incursions; ICAO Doc. 4444 PANS-ATM; and ICAO Annex 4 - Aeronautical Charts. Hot spots should be identified and brought to the attention of the aerodrome local Runway Safety Team. Hazards associated with hot spots should be mitigated as soon as possible and as far as is reasonably practicable. Operational staff needs to be made aware of hot spots at aerodromes.

Note: *Commission Regulation (EU) No 139/2014 AMC/GM provides additional advice; moreover, a EUROCONTROL Network Manager "Aerodrome Hot Spot Survey" report provides more guidance (best practice) on the depiction of hot spots on aeronautical charts.*

REPORTING CULTURE

Ensure it is easy for operational staff at your aerodrome to report runway incursions and other runway safety occurrences, including post-flight, for pilots after landing at the destination aerodrome. Ensure that the reporter receives feedback in a timely manner. Support the provision of a Just Culture for all operational staff. Make use of lessons learned for joint training and improvement of the aerodrome services, infrastructure and practices. The overall purpose of the safety reporting system is to use reported information to improve the level of safety performance of the aerodrome, and not to apportion blame.

***Note**: ICAO Annex 19 Safety Management, Commission Regulation (EU) No 139/2014 AMC/GM and Regulation (EU) No 376/2014 provide further advice on safety reporting systems.*

EXCHANGE OF LESSONS LEARNED AND BEST PRACTICES

The problem of runway incursions is still considered to be one of the top safety issues to be resolved in aviation. Consequently, an important objective for aerodrome local Runway Safety Teams is to raise awareness of the operational hazards of working on the manoeuvring area and share good practices to prevent runway incursions.

DISSEMINATION OF SAFETY RECOMMENDATIONS

An aerodrome local Runway Safety Team should ensure wide dissemination of the safety recommendations derived from accident and incident investigation findings as well as other relevant lessons learned, for example from operational experience, and best risk mitigation practices.

WHAT PILOTS WANT

Do not expect pilots to be familiar with local procedures. The difficulty encountered at aerodromes where EU/ICAO provisions are not respected, is the use of local, unique procedures and practices. Non-standard items have to be interpreted by the pilot for the pre-flight briefing or whilst taxing, from the cockpit.

What pilots need for safe operation on the manoeuvring area is the consistent use of internationally agreed standard phraseology, procedures and signs, markings and lighting. Pilots' wishes for standardisation of communication practices include:

- Use of standard phraseology in accordance with EU and ICAO provisions;
- use of signs, markings and lighting in accordance with ICAO Annex 14 – Aerodromes, Volume 1 – Aerodrome Design and Operations;
- enhanced situational awareness, based on the use of one language – aviation English;
- short, unambiguous taxi clearances, with no more than 2 sets of numbers to remember at a time. Special consideration should be given to new information;
- enough sectors / frequencies to avoid congestion of the R/T channels;
- complete information about expected taxi routing and stand, taxi-out routing and runway well in advance; and
- accurate aerodrome charts and essential information on aerodrome conditions- sources would be ATIS, NOTAMs and, in some circumstances to be decided locally, real-time radio communications.

PREPARING A RUNWAY SAFETY PROGRAMME FOR YOUR AERODROME

The aerodrome local Runway Safety Team 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.

Although not considered a regulatory authority or intended to replace any required component of a Safety Management System (SMS), the aerodrome local RST is aimed to improve and support runway safety by integrating the safety systems of the participating organisations (stakeholders). Interfacing service providers should document the interface between the SMS and

the aerodrome local RST, where aerodrome local RSTs are available.

When preparing a runway safety programme for your aerodrome each action item should designate a responsible person or organisation for completing the relevant tasks. There may be more than one person or organisation affected by an action item; however, one person or organisation should take the lead and be responsible for the completion of all the tasks associated with the action item. A realistic time frame to accomplish the work should also be associated with each action item.

TASKS

A number of the recommendations contained in the Action Plan can be dealt with by the aerodrome local Runway Safety Team.

One important task is the identification of potential runway safety issues. It is essential to ask the question 'What' can go wrong 'Where' and 'Why'. To provide workable answers it is necessary to review aerodrome practices regularly, and when relevant information is available, from incident investigation findings.

It is important to ensure that:

- suitable data is available to provide evidence for making decisions;
- findings from incident and accident investigations are analysed and understood;
- lessons learned from incidents and accidents related to runway safety issues from other aerodromes, as well as one's own aerodrome are taken into account;
- properly expressed safety concerns from operational staff are considered even if no significant safety event has yet occurred i.e. avoid the "it hasn't gone wrong yet" mind-set;
- reviews take place in different weather and light conditions to assess all runway entrances and visual aids to check that they are correctly located and clearly visible to pilots and drivers;
- lights, signs and markings are checked for conspicuity at a height similar to the height of the smallest and largest aircraft and vehicles using the manoeuvring area; and
- all markings and signs should be adequate for and understandable by all parties, with no possible ambiguity of their meaning.

In any review the aerodrome local Runway Safety Team should take into account runway and taxiway layout, traffic intensity and mix, and both visual and non¬-visual aids such as markings, lights, signs, radar, taxiway designations, ATS procedures, AIP information etc.

When examining operating procedures, it is necessary to ensure that procedures employed by different companies at the aerodrome are robust, integrated and effective so as to minimise the risk of runway incursions. Extra care should be taken when examining existing or proposed runway capacity enhancing procedures or noise abatement schemes involving runway preferential systems. A Safety Risk Assessment should be made before implementing such procedures.

Review proposed changes to the runways adjacent taxiway and apron infrastructure in the light of Runway Incursion sensitivity and provide advice to the aerodrome operators or building contractors.

Measure the effectiveness of operational solutions periodically. This can be accomplished by comparing the results of the initial analysis with 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.

Another important task for the aerodrome local Runway Safety Team should be to assist in keeping a spotlight on the subject and to develop and run local awareness campaigns.

The timing of awareness campaigns is important, choosing to make a runway safety briefing at the start of a busy season, or just before an air show or similar unusual activity can be helpful to all operational staff.

A possible output could be the production and distribution of local hot spot maps or other guidance material as considered operationally necessary. Hot spot maps may point out unique or complex intersections and runway crossings where runway incursions have taken place in the past or areas of the runway or associated taxiways which are not visible from the Control Tower. Consideration shall be given to publishing these maps via the AIP. An example extract of a local map, often referred to as a 'Hot Spot Map', produced by Barcelona Airport is shown.

Notes:

1. *Best practices used in the production of hot spot maps are listed in the EUROCONTROL Network Manager "Aerodrome Hot Spot Study Report" http://skybrary.aero/index.php/Ground_Operations.*

2. *Further information concerning the designation and publication of hot spots is also provided in Appendix H.*

3. *The Collaborative Aerodrome Safety Hotspots (CASH) Project introduced in France also provides aerodrome safety related information (in French):*

   https://www.ecologique-solidaire.gouv.fr/collaborative-aerodrome-safety-hotspots-cash

Other tasks could include, assisting in verifying that communications between air traffic controllers, pilots and vehicle drivers are satisfactory, or if any improvements could be suggested. For example, although standard ICAO phraseology may be used, some messages from ATC may be overlong or complex, which may have the potential to confuse vehicle drivers or pilots.

The inherent difficulties of communicating on the manoeuvring area mean that aerodrome design, visual aids and infrastructure naming conventions play an important part in reinforcing the intended instructions passed by the air traffic controller.

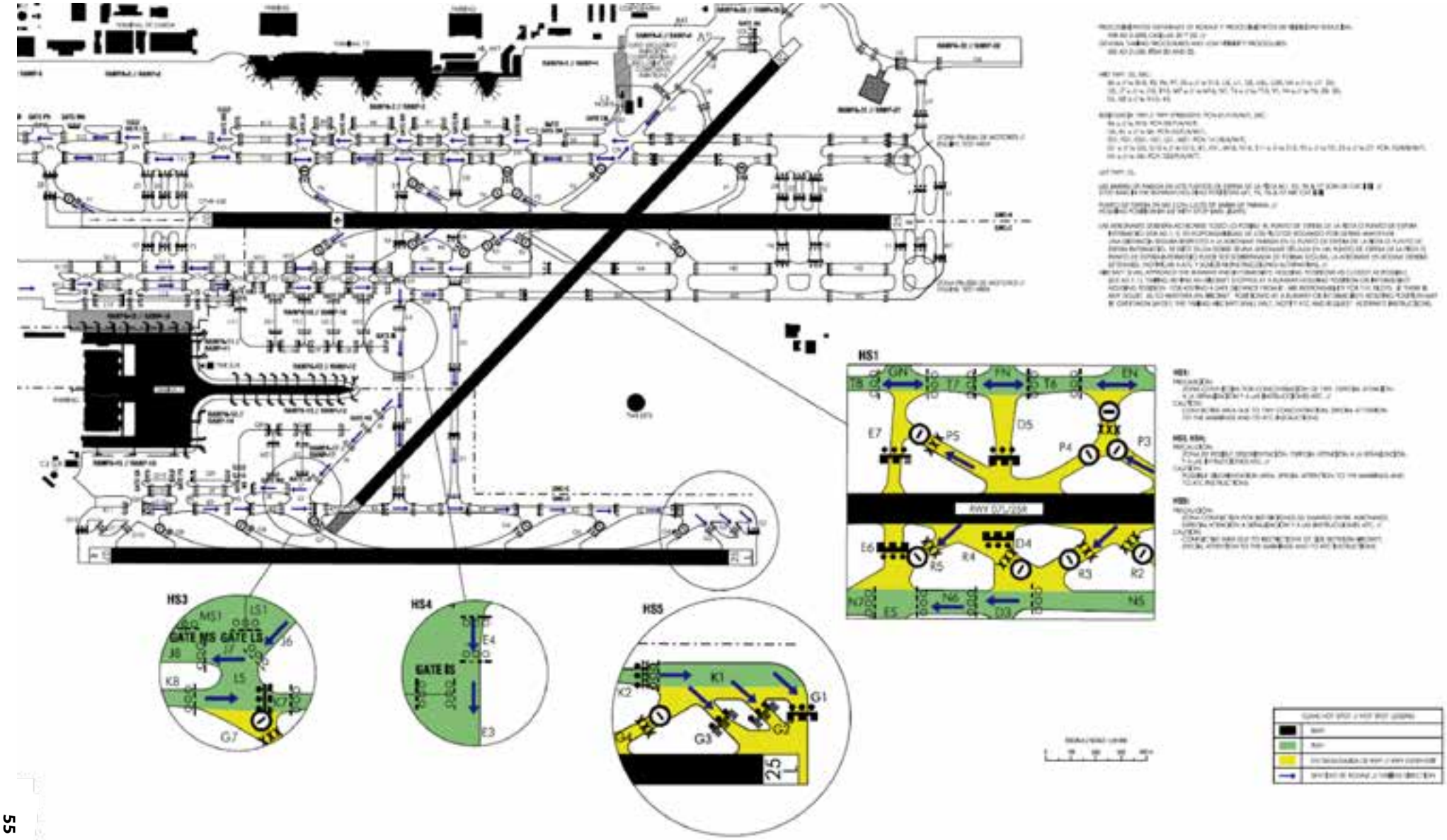
It is suggested that some members of an aerodrome local Runway Safety Team participate in safety case work, regarding changes to existing, procedures or infrastructure involving runways.

Aerodrome local Runway Safety Teams can play a role in preparing the briefing pack for new users of an aerodrome, or for a new high season.

The guidance found in this Action Plan should not be seen to be limiting and good practice should be shared as appropriate. The boundaries set by national regulators and internationally accepted provisions should be respected.

Technology is available to help to prevent runway incursions and may be considered to supplement good manoeuvring area practices by enhancing situational awareness e.g. through the use of appropriate alerting functions.

Extract from Hot Spot Aerodrome Chart - published in the AIP



JOINT TRAINING

Recommendation 1.1.4: Promote and make available specific joint training and familiarisation in the prevention of runway incursions to Pilots, Air Traffic Controllers and Manoeuvring Area Vehicle Drivers.

Education and awareness of the aerodrome local Runway Safety Team's achievements, can be communicated via training syllabi, newsletters, posters, stickers and the use of forums, on-line and in workshops.

Also, as part of the 'one team' approach to runway safety, airside drivers should be encouraged to visit apron control /air traffic control as part of their training. Equally, apron/ air traffic controllers should be encouraged to go out with airside drivers to understand, for instance, what it is like to drive a tug on the aerodrome.

Training on runway safety matters may be a supplement to core content training or EU Ops syllabi for licensing and certification and may also be included in the continuation training for air traffic controllers. EUROCONTROL provides joint training for air traffic controllers, pilots and manoeuvring area drivers called Aerodrome Resource Management (ARM). This training provides insight into the common runway incursion causal and contributory factors (such as expectation bias) and how to deal with difficult situations such as regaining situational awareness and control of the present traffic situation. The ARM also emphasises the importance of aerodrome local Runway Safety Teams in the prevention of runway incursions and 'trains the trainers' to improve the effectiveness of course participants in aerodrome local Runway Safety Team activities.

RAISE AWARENESS OF RUNWAY SAFETY MATTERS

Ensure globally accepted practices to prevent runway incursions are part of your local practices and that their significance is locally understood, e.g. Never cross (or instruct a vehicle or aircraft to cross) an illuminated red stop bar.

Set up a user friendly email address to ease communication e.g. lrst@xyzairport.aa

The ICAO Runway Safety Toolkit (http://cfapp.icao.int/tools/RSP_ikit/story_flash.html) provides information for educational and awareness programmes.

ASSESSING THE EFFECTIVENESS OF AERODROME LOCAL RUNWAY SAFETY TEAMS

Recommendation 1.1.1: Assess the implementation and operation of aerodrome local Runway Safety Teams and consider if and how changes could be made to increase their effectiveness in developing runway safety actions.

Recommendation 1.1.2: Implement local runway safety awareness campaigns and assess their effectiveness at each aerodrome for Air Traffic Controllers, Pilots and Vehicle Drivers and other personnel who operate on or near the runway. Consider format, method of delivery, frequency and feedback.

Establishing an aerodrome local Runway Safety Team is only the start. As part of a continuous safety improvement programme, aerodrome local Runway Safety Teams should periodically assess the effectiveness in the way that they work and the safety outcomes that they produce. In this context, the following areas could be addressed;

- The composition, role, terms of reference, tasks and associated safety programmes should be assessed against industry best practice and available guidance materials (e.g. ICAO Runway Safety Team Handbook).
- Evidence to support that RST proceedings are properly captured:
  - Aerodrome local RST attendance and participation records.
  - Minutes of aerodrome local RST meetings.
  - Safety risk assessments and associated recommendations and an action log/plan.
  - Runway incursion hazard log and corrective actions.
- Impact of runway incursion prevention activities and campaigns to improve safety: consider format, method of delivery, frequency and feedback.
- Processes and formal agreements governing the sharing of safety data, safety reports and safety information should be verified.
- Exchange visits to other aerodrome local Runway Safety Teams to observe how they operate may also provide additional ideas how to improve effectiveness.

- Internal and external (e.g. APEX) audits/surveys can also help aerodrome local Runway Safety Teams improve their overall efficiency and effectiveness.

REFERENCES

International Civil Aviation Organisation (ICAO)

- Annex 19 – Safety Management Systems
- ICAO PANS Aerodromes Doc. 9981 (Note: A new edition is planned to be published in 2019 and to become applicable in 2020)
- ICAO Doc. 9870 Runway Incursion Prevention Manual: Chapter 3. Establishing a Runway Incursion Prevention Programme 3-7: www.icao.int/fsix/res_ans.cfm
- ICAO Runway Safety Team Handbook Edition 2.0 June 2015

European Union

Commission Regulation (EU) No 139/2014 laying down requirements and administrative procedures related to aerodromes, specifically ADR.OR.D.005 and associated AMC/GM

Commission Regulation (EU) 376/2014 on the reporting, analysis and follow-up of occurrences in civil aviation

EUROCONTROL

- European Organisation for the Safety of Air Navigation (EUROCONTROL) http://www.eurocontrol.int/articles/runway-safety
- Aerodrome Resource Management (ARM) Training: http://www.eurocontrol.int/training
- EUROCONTROL Network Manager Safety Study – Aerodrome 'Hot Spot' Survey – May 2015.
- SKYbrary www.skybrary.ae .

Airports Council International (ACI)
https://www.aci-europe.org/

- Airport Excellence (APEX) in Safety programme: http://www.aci.aero/APEX

ACI Runway Safety Handbook 2014

Air Services Australia
www.airservicesaustralia.com

Federal Aviation Administration (FAA)
https://www.faa.gov/airports/runway_safety/

International Air Transport Association (IATA)
www.iata.org

International Federation of Airline Pilots' Associations (IFALPA) www.ifalpa.org

Transport Canada
http://www.tc.gc.ca/eng/civilaviation/standards/systemsafety-posters-tools-3487.htm

United Kingdom Safety Regulation Group
http://www.caa.co.uk/home/

- UK CAP 1069, Preventing runway incursions at small aerodromes

France DGAC
Collaborative Aerodrome Safety Hotspots (CASH) Project
https://www.ecologique-solidaire.gouv.fr/collaborative-aerodrome-safety-hotspots-cash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APPENDIX C
AIRSIDE VEHICLE DRIVER TRAINING

Introduction

Training Delivery

Framework for an Airside Vehicle Driver Training Programme

Framework for Manoeuvring Area Vehicle Driver Training Programme

Framework for a Radiotelephony (RTF) Training Programme

Summary

References

Useful Web sites

APPENDIX C AIRSIDE VEHICLE DRIVER TRAINING

INTRODUCTION

Studies and data show that vehicles and their drivers continue to be involved in runway incursions. It is the responsibility of the Aerodrome Operator to have in place, a formal training, assessment, proficiency check and authorisation programme for all drivers operating airside.

Notes:

1. *Commission Regulation (EU) No 139/2014 laying down requirements and administrative procedures related to aerodromes (plus Acceptable Means of Compliance and Guidance Material) also contains useful information for the control of aerodrome drivers.*

2. *The new edition of ICAO Doc. 9981, PANS Aerodromes due to be published in 2019 will include a dedicated chapter on Aerodrome driver permit schemes, focused mainly on the safety aspects associated with airside driving.*

As a result of local hazard analysis the operation of vehicles on the aerodrome should 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 (SMS) of the Aerodrome Operator.

The Aerodrome Operator is responsible for 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 Service Providers airside to ensure the continued operation of the programme.

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

- 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 aprons, stands and airside roads.

- Specific training on the vehicle, plant and equipment, e.g. car, tug, high loader, coach.

- Where the specific job function requires the driver to operate on the manoeuvring area then additional training on the hazards associated with runways and taxiways should be covered.

- An essential requirement of operating a vehicle on the manoeuvring area is the need to use VHF radio communications with Air Traffic Control that will require training in the correct use of RTF, standard phraseology and, where required, aviation English.

- Works In Progress.

The following programmes describe what may be considered as 'good practice' guidance for Airside and Manoeuvring Area vehicle driver training, with special attention given to a separate programme for radio telephony training. The guidance is a compilation of material drawn from many sources including ICAO, IATA, ACI and a large number of aerodromes that already operate vehicle driver training programmes. It is vital that both theoretical classroom training and practical experience cover all the areas mentioned. 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'; therefore, it may be applied to the majority of aerodromes.

TRAINING DELIVERY

The three training programmes are intended as generic guidance and each aerodrome will need to apply those areas of training that are applicable to their local geography, conditions and type of operation.

All of the three training programmes should consist of two main parts, the first being the classroom/theoretical part which should include the use of prepared presentations, maps, diagrams, video, booklets, checklists as appropriate. The second part should involve practical tuition and visual familiarisation on the aerodrome and/or in a suitable airside driving simulator with a suitably trained person. This practical tuition will take a period of time depending upon the complexity of the aerodrome; theoretical and practical tests/examinations should also be used to ensure that drivers have reached an appropriate level of proficiency before issuing any form or airside driving permit.

Following initial training, a programme of refresher training should be organised after an agreed period of time. For drivers that have access to the runway(s) this should not normally exceed one year, whereas for apron and other manoeuvring area drivers this period could be extended.

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

FRAMEWORK FOR AN AIRSIDE VEHICLE DRIVER TRAINING PROGRAMME

The Airside Driving Permit (ADP)

- The issuing authority (normally the aerodrome operator):
  - its validity in terms of time;
  - conditions of use;
  - non-transferability of ownership of the permit; and
  - control and audit of permit issue.

Note: *Airside driving permits affording access to runways should be kept to the minimum and subjected to 'recency' of use checks to ensure that the permit holder still needs to drive on the runway(s).*

- Local enforcement and driving offence procedures.
- Relationship to State driver licensing system.

National Legislation and Regulation

- Government/State regulations related to general vehicle driving licences.
- State/Regional/Local government requirements.
- Regulatory requirements/guidance for driving airside.

Aerodrome Regulations and Requirements

- Rules of Air Traffic Control, rights of way of aircraft.
- Specific aerodrome regulations, requirements and local instructions.
- Local methods used to disseminate general information and instruction to drivers.
- Local methods used to disseminate information regarding works in progress.

Right of Way on the Ground

- Vehicles must always give priority to taxiing aircraft, aircraft on tow or being pushed back and aircraft with their anti-collision lights on.

Personal Responsibilities

- Fitness to drive (medical/health standards) national or airport agreed requirements (alcohol/drugs).
- Issue and use of personal protective equipment such as high visibility clothing and hearing protection.
- General driving standards.
- No smoking requirements airside.
- Responsibilities with respect to FOD and fuel/oil spillage.
- Responsibility for individuals to ensure vehicle is suitable for the task and used correctly.
- Concentration – no use of mobile phones/portable electronic devices for personal use

Note: *In addition to above, 'sterile cab' procedures - similar to 'sterile cockpit' principles/procedures used by airlines - can further improve concentration levels and reduce potential distractions. In a 'sterile cab' only direct operational work related matters should be discussed (e.g. between the driver and any co-driver/passengers) whilst the vehicle is operating on or in the vicinity of the runway(s).*

Vehicle Standards

- Condition and maintenance standards agreed at aerodrome and/or national level.
- The requirement to display obstruction lights and company insignia.
- Requirements and content of daily vehicle inspections.
- Agreed standards of aerodrome and company vehicle fault reporting and rectification.
- Local requirements for the issue and display of Airside Vehicle Permits (AVP's).

General Aerodrome Layout

- The general geography of the local aerodrome.
- Aviation terminology used such as runway, taxiway, apron, roads, crossings etc.
- All standard aerodrome signs, markings and lights for both vehicles and aircraft.
- Specific reference to those signs, makings and lights used to guard runways.
- Specific reference to any controlled/uncontrolled taxiway crossing procedures.
- Specific reference to the runway(s) Protected Area and associated chart/map.
- Specific reference to known aerodrome 'Hot Spots' as they may affect airside/manoeuvring area drivers.

Hazards of General Airside Driving

- Speed limits, prohibited areas and no parking regulations.
- The danger zones around aircraft.
- Engine suction/ingestion and blast, propellers and helicopters.
- Aircraft refuelling, fuelling zones, vehicle access/exit.
- FOD and spillages.
- Vehicle reversing, use of banksman.
- Staff and passengers walking across aprons, rights of way.
- Air-bridges and other services such as fixed electrical ground power.
- The general aircraft turnaround process.
- Aircraft emergency stop and fuel cut off procedures.
- Hazardous cargo.
- Local vehicle towing requirements.
- Requirements for driving at night.
- Requirements for driving in adverse weather conditions, particularly low visibility.

Local Organisations

- The role of the Aerodrome Operator in setting and maintaining standards.
- The Regulator and its responsibilities.
- The National and/or local Police and their involvement with airside driving other enforcement authorities dealing with vehicles, driving, health and safety.

Emergency Procedures

- Action to be taken in the event of a vehicle accident.
- Specific action to be taken in the event of a vehicle striking an aircraft.
- Action to be taken in the event of fire.
- Action to be taken in the event of aircraft accident/ incident, including procedures and clearances to enter the runway.
- Procedures to be used by vehicle drivers if lost or unsure of position.

- Action to be taken in the event of personal injury.

Communications

- The role of the Aerodrome Operator in setting and maintaining standards.
- The Regulator and its responsibilities.
- The National and/or local Police and their involvement with airside driving other enforcement authorities dealing with vehicles, driving, health and safety.

Practical Training (Visual Familiarisation)

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

Synthetic Driver Training Aids

The use of airside/aerodrome driving simulators can provide a number of additional benefits to help airside/aerodrome visual familiarisation:

- Supplement theoretical class room training.
- Allow drivers to practice driving airside, including use of radios, in a safe, learning environment.
- Reduce the amount of 'live' airfield driving for training purposes – in particular on runways.
- Reduce overall training burden – time saving.
- Reduce vehicle physical wear and tear, and fuel consumption.

FRAMEWORK FOR MANOEUVRING AREA VEHICLE DRIVER TRAINING PROGRAMME

It is anticipated that all drivers expected to operate on the Manoeuvring Area of an aerodrome will obtain an airside vehicle driver's permit which has covered the programme detailed previously. It is also anticipated that any driver expected to drive on the manoeuvring area will have obtained an agreed period of experience of general airside driving before training to operate on the manoeuvring area.

The numbers of drivers permitted to drive on the manoeuvring area – especially the runways - should be kept to the minimum necessary and regularly reviewed. The functions they perform should normally be within the following areas of responsibility

- Runway and taxiway inspections.
- Bird Control.
- Rescue and Fire Fighting.
- Essential Engineering.
- ATC.
- Snow clearing and De-icing.
- Airline/Handling agent for aircraft towing and runway crossings.
- Escort Duties: Note: Specifically, managing groups/convoys of vehicle and actions to be taken (e.g. inform ATC) if an escort 'loses' a vehicle(s).

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

Aerodrome Regulations and Requirements

- Rules of Air Traffic Control, rights of way of aircraft.
- Definitions of movement area, manoeuvring area, aprons, stands.
- Methods used to disseminate information regarding works in progress.

Air Traffic Control

- All access to a runway (even if inactive) should take place only after receiving a positive ATC clearance and providing a correct readback, and after the stop bar (where provided) has been switched off; entering a runway without a valid ATC clearance will create a runway incursion, irrespective of the status of aeronautical ground lighting. Function of aerodrome control and its area of responsibility including the extent of Protected Area(s).
- Function of ground movement control and its area of responsibility.
- Normal and emergency procedures used by ATC relating to aircraft.
- ATC frequencies used and normal hand over/transfer points for vehicles.
- ATC call signs, vehicle call signs, phonetic alphabet, standard phraseology.
- Demarcation of responsibilities between ATC and Apron Control if applicable.
- Familiarisation with low visibility procedures and the changes they bring to maneuvering area vehicle operations.

Personal Responsibilities

- Fitness to drive with particular emphasis on eyesight and colour perception.
- Correct use of personal protective equipment; Responsibilities with respect to FOD.
- Responsibilities with respect to escorting other vehicles / aircraft on the manoeuvring area.
- Awareness briefing at the start of a shift.
- Consider adoption of 'sterile cab' procedures to ensure concentration whilst driving airside/on the manoeuvring area.

Briefing

Manoeuvring area drivers should be briefed at the start of shift so they are aware of the airfield status. This should include:

- The runways in use.
- If airfield low visibility procedures are in force.
- Any significant works areas in place, or being established or removed that day.
- Stop bars that are inoperable making the taxiway unusable for runway entry or crossing.
- Specific phraseology to be used when a driver is given permission to spend time in a specified area for an extended period, to avoid misunderstandings of the exact boundaries of the clearance.

Manoeuvring area drivers should also ensure they carry an up to date airfield map (incorporating runway protected areas) in the vehicle and ensure that situational awareness is maintained.

Note: *'Moving map' type functionality can alert drivers when approaching a protected area or when entering one. A physical or technical means to record clearances can also help maintain driver situational awareness – see Appendix M.*

Vehicle Standards

- Responsibility to ensure vehicle used is fit for purpose and task e.g. vehicles airside should have fitted, and drivers should use, flashing yellow lights (ideally all of airside, but at a minimum those driven on the manoeuvring area).
- Consider fitting a dashboard mounted compass in vehicles.
- Requirements for daily inspection prior to operating on the manoeuvring area.
- Particular attention to the display of obstruction and general lights.
- Serviceability of all essential communications systems with ATC and base operations.
- Serviceability of vehicle transponders (where fitted) for A-SMGCS.

Aerodrome Layout

- Particular emphasis on standard ICAO signs, markings and lights used on the maneuvering area.
- Special emphasis on those signs, markings and lights used to protect the runway; particular attention should be given to stop bars and autonomous runway incursion warning systems (e.g. Runway Status Lights) where these are installed.
- Extent of runway protected areas with associated Protected Area chart/map.
- Description of equipment essential to air navigation such as ILS.
- Description of protected zones related to ILS antenna.
- Description of ILS protected areas and their relation to runway holding points.
- Description of runway instrument/visual strip, cleared and graded area.
- Description of lights used on the manoeuvring area with particular emphasis on those related to low visibility operations e.g. particular care should be taken if a contingency procedure to be used in Low Visibility Operations or at night turns off the green taxiway centreline lights linked to an inoperable stop bar.

Hazards of Manoeuvring Area Driving

- Engine suction/ingestion and blast, vortex, propellers and helicopter operations.
- Requirements for driving at night.
- Requirements for operations in low visibility and other adverse weather conditions.
- Procedures for vehicle, radio and/or transponder (as applicable) becoming unserviceable whilst on manoeuvring area.
- Rights of way for aircraft, towed aircraft and RFFS vehicles in emergency.
- Being familiar with how aircraft under tow will appear at night or in reduced visibility conditions.

Emergency Procedures

- Actions to be taken in event of vehicle accident/ incident.
- Actions to be taken in event of aircraft accident/ incident.
- Actions to be taken if FOD or other debris is found on runways and taxiways.
- Procedures to be used by drivers if lost or unsure of position.
- Local emergency telephone number.

Aircraft Familiarisation

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

Practical Training (Visual Familiarisation)

- All runways (including access and exit routes), holding areas, taxiways and aprons.
- All signs, surface markings and lights associated with runways, holding positions, CAT I/II/III operations.
- All signs, surface markings and lights associated with taxiways.
- Specific markings that demarcate the boundary between aprons and manoeuvring area.
- Navigation aids such as ILS, protected area, antenna, RVR equipment and other meteorological equipment.
- Hazards of operating around aircraft landing, taking off or taxiing.
- Any locally used naming convention for particular areas or routes.
- Knowledge of standard taxi routes, primarily intended for aircraft.

Note: *Aerodrome driving simulators can be used to supplement all aspects of this training.*

FRAMEWORK FOR A RADIOTELEPHONY (RTF) TRAINING PROGRAMME

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

All drivers of vehicles operating on the manoeuvring area should be expected to display a high degree of competence with respect to use of RTF phraseology and, where required, Aviation English.

Notes: *Some aerodromes have adopted the so-called 'Triple One' practice, namely: One Runway, One Frequency, One Language (English) as means to improve the situational awareness of drivers and pilots.*

Hierarchy of Message Priority

- Message priorities, understanding of distress, alerting, control, information messages.
- When on the manoeuvring area, messages from ATC take priority; this may mean reducing the volume of other transmissions to ensure correct message exchange..

Use of the Phonetic Alphabet

- Correct pronunciation of letters, words and numbers.

Use of Standard Phraseology

- Emphasis on drivers using standard phraseology similar to pilots; some aerodromes have defined additional phraseology for driver- controller communications.
- Avoid certain phrases such as 'cleared', and 'go ahead'.

Use of Call Signs for Aircraft, ATC and Vehicles

- Understanding of terminology and acronyms used by ATC and pilots.
- Knowledge of the airline call signs used at the aerodrome.
- Vehicle call signs should be appropriate to function e.g. 'Operations', 'Fire', 'Engineer', where there is more than one vehicle the use of numbers e.g. 'Fire 2'. In addition, where practicable, consider unique/discrete vehicle numbers to reduce the chances of vehicular call sign confusion especially between different agencies, i.e. avoid the use of 'Operations One' and 'Fire One'.

Use of Readback Procedures

- Vehicle drivers should use standard readback in the same manner as pilots for instructions such as 'enter/cross the runway'.

Readability Scale

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

Aerodrome information

- Expect that ATC will provide real time significant aerodrome information which may affect operations on or near the runway when NOTAMS and ATIS (which are normally used to advise pilots of significant information regarding runway operations) are not available.

Lost or Uncertain of Position

- Understanding of local communication procedures for vehicles lost or uncertain of position on the manoeuvring area.

Vehicle Breakdown

- Local procedure for vehicle breakdown on runways and taxiways.
- Procedure for indicating to ATC of vehicle failure.

Radio Fail Procedure

- Understanding of the local procedure if radio failure occurs whilst on the runway or taxiway.
- Understanding of the light signals that may be used by ATC to pass instructions to vehicles.

Correct Transmitting Technique and RTF Use

- Understand the reasons for listening out prior to transmitting, especially if operating on the Tower (runway) frequency whilst on the runway.
- Use of standard phraseology, aviation English.
- Words and sounds to be avoided.
- Correct positioning of microphones to avoid voice distortion.
- Avoidance of 'clipped' transmissions.
- Be aware of regional accents and variations of speech.
- Speed of delivery of RTF phraseology.

Use of Portable Radios

- Correct use of radios.
- Effective range and battery life.
- Screening/shielding effects on the aerodrome.
- Use of correct call signs, either related to vehicle or an individual person.

Safety whilst using Radios

- Local instructions regarding use of portable radios and hand held microphones whilst driving a vehicle.
- Local instructions on the use of mobile telephones (cell phone) whilst operating airside

Practical Training

- On the job training under supervision.

Aerodrome driving simulators can be used to supplement all aspects of this training.

For more information about communication practices on the manoeuvring area, refer to Appendix A - Communication.

SUMMARY

The above frameworks are intended only as guidance and are based on current 'good practice'. Aerodromes should regularly review their vehicle driver training programmes against programmes and documentation available across the industry.

REFERENCES

1) Airports Council International ACI (World) Runway Safety Handbook

2) Airports Council International ACI (World) Apron Markings and Signs Handbook

3) IATA Airport Handling Manual (AHM) current edition

4) UK Civil Aviation Authority CAP 642 - Airside Safety Management

5) Requirements for an Airside Driving Permit (ADP) Scheme, UK CAA CAP 790

6) Commission Regulation (EU) No 139/2014 (and associated Acceptable Means of Compliance (AMC)/ Guidance Material (GM)

7) ICAO Annex 14 - Aerodromes, Volume 1 - Aerodrome Design and Operations, Ch. 8, Aerodrome Vehicle Operations, and attachment A, para. 17 - Operators of vehicles

8) ICAO Doc. 4444, PANS-ATM Ch. 7 Procedures for Aerodrome Control

9) ICAO Doc. 9981, PANS Aerodromes
*(**Note**: A new edition is planned to be published in 2019 and to become applicable in 2020)*

10) Airside Vehicle Drivers Guide Air Services Australia

11) EUROCONTROL Network Manager Safety Study "The Impact of Airside Drivers on Runway Safety" 2015

USEFUL WEB SITES

ACI:
https://www.aci-europe.org/ and
http://www.aci.aero/APEX

EASA:
www.easa.eu

EUROCONTROL:
www.eurocontrol.int/runwaysafety

IATA:
www.iata.org

UK CAA:
www.caa.co.uk

Air Services Australia:
http://www.airservicesaustralia.com/


AirEuropa

APPENDIX D
AIRCRAFT OPERATOR/FLIGHT CREW BEST PRACTICES

Sterile Cockpit for Safety

Communications

Situational awareness

Navigating on the ground - Visual aids

YOU CAN HELP TO PREVENT RUNWAY INCURSIONS!

Training

Best Practices Planning of Airport Ground Operations

References

APPENDIX D AIRCRAFT OPERATOR/FLIGHT CREW BEST PRACTICES

Runway incursions often involve misunderstanding/ communication breakdown between operational staff e.g. pilots, vehicle drivers on the manoeuvring area and air traffic controllers. Miscommunication can lead to a loss of situational awareness and a ground navigation error. The majority of runway incursions occur during taxiing out and departure operations.

Aircraft Operators are invited to review the materials put forward, and where necessary, amend their Standard Operating Practices with regard to ground operations.

Principle points to highlight for pilots include:

- Runway incursions may lead to Go-arounds or indecision about whether to Go-around or not;
- Inexperience, lack of practice with procedures or unclear procedures may lead to runway incursions;
- Air ground lighting is an important guidance when on or near a runway;
- Aerodrome infrastructure design is important to building situational awareness;
- A current aerodrome chart is essential for accurate navigation on the ground;
- Errors by air traffic controllers, pilots or drivers are typically caught within their peers. Thus pilots play an important part in catching the errors they have made themselves, other pilots and air traffic controllers;
- In today's air traffic management system, compliance with ICAO requirements to use aviation English on the manoeuvring area is a vital safety net.
- Not gathering (i.e. not seeing or hearing) information clearly or correctly is a frequent cause of incursions when left unchallenged. An important communication factor in runway incursion incidents is incorrect or incomplete readback by pilots or air traffic controllers, particularly when conditional clearances are used.
- Misunderstandings are more likely to arise when a pilot is doing other tasks, being head-down.

Examples of this are conducting aircraft performance calculations, deferred checklist items, administrative tasks, starting an engine during an engine-out taxi, etc.

Safety reports show that Public Address announcements to passengers or commercial announcements are a direct source of error in many events.

STERILE COCKPIT FOR SAFETY

A key point in the prevention of runway incursions is to apply better preventative measures during the taxi-phase. Reduced workload will provide for increased attention to the taxi phase and allow an updated and accurate positional and situational awareness.

The current generation of aircraft is highly automated with complex systems, which allow preparation and programming of the total flight on the ground. Flight deck workload peaks have been shifted to now also include the ground phase of aircraft operations. Appropriate measures should be undertaken to accommodate flight crew workload on the ground. The taxi phase should be treated as a "critical phase of flight". Thus it is strongly advised to adopt the sterile flight deck concept whilst taxiing.

During movement of the aircraft the flight crew must be able to focus on their duties without being distracted by non-flight related matters. This includes public address announcements, performance (re)calculations, administrative tasks, briefings, items like flight control checks, and or checklists. Preferably these should all be completed before taxi-out. Taxi items should come after start items. If an unforeseen change makes any of these actions necessary after commencement of taxi, they should be done with the aircraft stopped and the parking brake set. Ensure cabin crews are aware of this requirement if it is not a Standard Operating Procedure. The following definition of a 'Sterile Flight Deck' is offered as a reference:

Sterile flight deck definition:

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

It is generally accepted that the sterile flight deck applies as follows:

a) Departure: when the aircraft starts engine/s and ceases when the aircraft reaches 10,000' above the departure aerodrome elevation.

b) Arrival: when the aircraft reaches 10,000' above the arrival aerodrome elevation until the engine/s are shut down after landing.

c) Any other times decreed by the flight crew. (E.g. in flight emergency, security alert etc)

During taxi preferably both pilots should be looking outside. The pilot not flying should only handle essential check list reading and communication. If a runway change or intersection change or performance recalculation is required, then it is advised to stop the aircraft and do the required items after the parking brakes are set. ATC should accept this as a normal procedure. Pilots may delay computer re-programming, performance re-calculations and briefings until aircraft is stopped at the runway holding point.

Disturbances that can be avoided may include, but not be limited to, calls received from non-operational areas (e.g. company), entry onto the flight deck (e.g. cabin crew) and extraneous conversations not related to the current phase of flight. Public Address e.g. welcome announcements by flight deck should be transferred from the taxi phase to a moment before engine start-up or push back. Operational calls on the company frequency cause the other pilot to be isolated in the flight deck. These calls and announcements should, if at all possible, be avoided while taxiing, and above all, when approaching the active runway.

Note: *EASA GM1 ADR – DSN.M.745 states that "Active runway is to consider any runway or runways currently being used for take-off or landing. When multiple runways are used, they are all considered active runways."*

Engine Out Taxiing (EOT)

Due to the multiple safety, efficiency and operational factors which vary for every aircraft, airport lay-out, weather conditions, surface conditions and traffic load, Engine Out Taxiing (EOT) procedure should not be mandatory and crews should assess its application depending on conditions.

The incorporation of an approved, standardized EOT procedure into the Operations Manual, as part of the taxiing procedures, provided the relevant crew training is performed, should be mandatory if the procedure is to be applied. The EOT procedure must clearly identify and address any areas of potential confusion like responsibilities and task allocation during start up and shutdown, and criteria for when it may or may not be applied. Moreover, the Operations Manual shall clearly state that the EOT procedure is carried out at the Pilot-In-Command's discretion, after careful consideration of local and operational circumstances.

Such circumstances include but are not restricted to:

1. Local airport restrictions on such operations, for example taxiway/ramp surface gradients.

2. Manoeuvring space, tight turns and 180 degree- turns.

3. Possibility of Foreign Object Damage (FOD) due to increased jet blast.

4. Compliance with engine warm-up and cool down times for thermal stabilization as specified by the aircraft manufacturer.

5. Weather conditions and taxiway/ramp surface status (for example slippery, wet) that may preclude the application of the procedure.

6. Operating procedures related to aircraft system monitoring and checklist accomplishment, which must be consistent with a late engine start (during taxi-out) and/or an early engine shut-down (during taxi-in.)

If the Pilot-In-Command elects to carry out the EOT procedure in accordance with the above, the following factors should be taken into account:

1. Caution must be exercised when taxiing with one (for twin engine) or two engine(s) shut down, to compensate for the possible asymmetric force.

2. Slow and/or tight taxi turns in the direction of the operating engine may not be possible at high gross weight.

3. Aircraft system operation need to be carefully considered to ensure critical systems used for taxi remain operative, e.g. nose wheel steering, brakes, ice protection system.

An engine start procedure requires time and attention, which should not be detrimental to other taxiing duties, such as external visual scanning, systems monitoring and checklist accomplishment. Consideration should be given to the expected departure queue with regards to the time needed for engine start and "after start" items;

An engine should not be started:

1. By the pilot having the controls during taxi.
2. When taxiing on an apron or a complex taxiway layout.
3. When crossing an active runway.
4. When taxiing in low visibility conditions.

COMMUNICATIONS

The following guidelines, in addition to the formal R/T procedures as laid down in PANS-ATM, ICAO Doc. 4444 PANS-ATM might help pilots in maintaining adequate communication on the manoeuvring area.

See also Appendix A of this document (Communications Guidance) for further information.

- Expect that ATC will use the ICAO readback procedure (including drivers and other personnel who operate on the manoeuvring area) to confirm that the message is correctly understood.
- Improve situational awareness, when practicable, by conducting all communications associated with runway operations using aviation English.
- Improve situational awareness, when practicable, by conducting all communications associated with runway operations on a common frequency. This allows situational awareness of other traffic for you and the other traffic and can only be achieved when a message is understood by all meaning that all communications are conducted using aviation English on the runway frequency.

  *(**Note** - Aerodromes with multiple runways may use a different frequency for each runway)*

- Extra care should be taken when accepting a conditional clearance. Although a conditional clearance could be an aid in the situational awareness for specific situations, it might also restrict it. Therefore it is situation dependent.
- Proper crew resource management indicates that when in doubt, all available sources should be consulted. When one of the pilots would have missed an ATC call or is in doubt, it is a good practice to request it again. Similarly, if one crew member has a different perception of a situation or clearance to the other, ATC should be asked to clarify.
- Any clearance to cross or enter an active runway should be heard, understood, and confirmed by all flight crew members.

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. Even during daylight and in good visibility, people get lost. Even worse is the situation where you assume you know your position, but find yourself elsewhere. 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. If in doubt, seek clarification from ATC.

See also Appendix A of this document (Communications Guidance) for further information.

- If Pilots have any doubt as to their exact position on the surface of an aerodrome, they should stop and contact ATC and follow the associated ICAO procedure (Doc. 4444, PANS-ATM).
- Proper crew resource management indicates that when in doubt, all available sources should be consulted. When one of the pilots would doubt on the situational awareness, a good practice would be to stop the aircraft taxiing or get immediate clarification by ATC. Normally ATC is very familiar with the particular aerodrome and thus in the best position to help re-establish the situational awareness.
- Pilots should be "head-up" for a continuous watch while taxiing, and should maintain "sterile flight deck" during taxi phase. The pilot taxiing the aircraft should orient himself mostly by outside reference with the help of signs and ground markings. The other pilot should

continuously verbally give navigational information. Promote best practices on flight deck procedures while taxiing and during final approach - to include the "sterile flight deck" concept.

- All access to a runway (even if non-active) should take place only after receiving a positive clearance and providing a correct readback, and after the stop bar (where provided) has been switched off; entering a runway without a valid ATC clearance will create a runway incursion.

- Pilots shall not cross illuminated red stop bars when lining up or crossing a runway, unless contingency procedures are in force, e.g. to cover cases where the stop bars or controls are unserviceable. In this case, pilots should check with ATC that they are allowed to cross an illuminated stop bar.

- At the moment, stop bars and runway status lights are the only visual systems providing a clear red signal. This should be interpreted as a clear danger sign, thus stop taxiing.

- Crews approaching a runway with an instruction to hold short should stop the aircraft as close as possible to the holding point to make sure they clear taxiways behind them. However, the cockpit position must not cross the holding point markings and so allow the crew to continue to see all signs and markings, and the stop bars (where fitted).

- Ensure that flight deck procedures contain a requirement for explicit clearances to cross any runway, this includes non-active runways. This means that a conditional clearance for crossing should not be accepted.

- Ensure a means to indicate receipt of landing / line-up / take off / crossing clearances in the cockpit. Proper crew resource management indicates that when in doubt, all available sources should be consulted. Especially for runway operations it is essential that both pilots are fully aware of the factual clearance. ATC should cooperate as long as it takes for the crew to understand ATC instructions.

- During taxi for departure or during approach, Pilots should refrain from accepting a runway change proposal if time to re-brief is not sufficient. This includes a change of departure intersection. It is tempting to save time, fuel, capacity enhancement and for environmental reasons to accept a last minute change for another runway or runway entry. Pilots should be fully aware that this could lead to the hurry-up syndrome. A rushed crew is prone to make errors.

- Therefore it is absolutely imperative to make sure that enough time is available before accepting a last minute change. ATC should be aware to avoid the 'hurry–up' syndrome.

- Flight Crew should not enter a runway for departure if not ready to take off. This avoids the possibility that an aircraft is "forgotten" on an active runway. Advise ATC accordingly.

- Flight Crew should verify the correct runway holding position prior to entering for the purpose of taking-off or for crossing.

- Avoid accepting rapid exit taxiways for runway entry. A rapid exit taxiway is designed to be an exit, not an entry. Using it as an entry hampers visibility, poses a threat for exact performance calculations and does not guarantee adequate visual aids.

- Pilots should turn on aircraft forward facing lights when in receipt of a take-off clearance. The moment of switching proves to be an important aid for vehicle drivers or others on an active runway.

- The flight deck traffic display (TCAS) could also be a good tool to detect traffic approaching and departing a runway. Remember, an aircraft may be departing from an intersection closer to the landing threshold out of sight, due to restricted visibility, or line of sight limitations.

- Use your heading display or compass to confirm the runway alignment (QFU) with the information available from charts. If fitted, use the ILS centreline guidance system to confirm the correct runway alignment.

- Have a good look out; scan the entire runway and approach in both directions before entering a runway. If in doubt, seek clarification: ASK.

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

NAVIGATING ON THE GROUND - VISUAL AIDS

Charts, signs, markings and lighting: These are all aids to assist in determining your position. A high level of awareness must be maintained to observe and respond to mandatory signs and markings. A correct knowledge of all the symbols and signs is therefore a must. 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 deck crew. A crew member who is in doubt or does not agree with the situation must speak-up and a check should be made with ATC. Reports to ATC and the airport should be made when factual situations differs from procedures or published information.

Aerodrome taxi charts should include 'Hot Spots' during taxi, specially covering risk of runway incursions. This will help to increase pilots' situational awareness during the taxi briefing.

YOU CAN HELP TO PREVENT RUNWAY INCURSIONS! HOW?

1. It is essential to adhere strictly to all existing ICAO Standard Operating Procedures and phraseologies.

2. Flight crews need to ensure that they follow the clearance or instructions that are actually received, and not the one the flight crew is expecting to receive. If in doubt, ASK.

3. A good planning of the ground operations can decrease the workload during taxi. The flight and its associated risks start already during the preparation.

4. Good situational awareness is the top priority during taxi. All crewmembers should be involved here. Avoid heads down.

5. Application of the "Crew Resource Management" principles during taxi is as important as during the other phases of flight.

6. Even the most professional and experienced people make errors. By being defensive and letting the built-in safety nets do their work, a single error should not lead to a serious incident or accident.

7. Advise ATC if you think another aircraft may be about to enter a runway incorrectly or take-off/land incorrectly.

TRAINING

Although aircraft operators provide pilots with some training for ground manoeuvres, e.g. Low Visibility procedures, it is essential that pilots are fully acquainted with aerodrome signage, markings and lighting for safe runway operations, and that this knowledge is kept up to date through recurrent training.

BEST PRACTICES PLANNING OF AIRPORT GROUND OPERATIONS

(Refer to Recommendation 1.4.8)
Departing from, or coming to, an airport can be prepared well in advance. A thorough planning for taxi operation is essential. This preparation should be done at the gate or prior to starting descent.

Familiarise yourself with the airport

- Prepare the necessary charts for taxi and have them available for use during taxi.

- Take some time to study the airport layout. The naming of taxiways and other airport infrastructure can be misleading.

- Remember to review the latest NOTAM for both the Departure and Arrival airport for information concerning construction or taxiway/runway closures.

- Standard taxi routes are used more often at busy airports. Review the routes you can expect.

- Use the ATIS information and your previous experience to determine the possible taxi routes; to avoid possible late changes to taxi routes and departure clearances, be aware of scheduled runway configuration changes (e.g. from day to night) when planning flights

- Pay special attention to the location of HOT SPOTS. These are unique or complex intersections and runway crossings where runway incursions have taken place in the past or areas of the runway or associated taxi ways which are not visible from the Control Tower.

- Know what runways you will encounter between where you are and where you are going.

- Visualise this information on the charts.

- 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.

Briefing

- Conduct a detailed briefing for all flight crew members, especially during night and LVO. The visibility required for taxiing may be less than the Runway Visual Range.

- Brief planned primary runway exit and taxi route.

- Assigned taxi routes should be briefed as thoroughly as an instrument approach or departure.

- Airport diagrams should be readily available to all flight crew members.

- Check that the crew fully understands all briefing items. The human memory is "constructive". That means that we have the tendency to fill in the blanks.

- Reassure yourself that you follow the clearance or instruction that you actually received, and not the one you expected to receive (confirmation bias).

Taxiing – navigating on the ground

Departing from, or coming to, an airport can be prepared well in advance. A thorough planning for taxi operation is essential. This preparation should be done at the gate or prior to starting descent.

- Write down taxi route.

- Be alert for mandatory signs, markings, stop bars and runway guard lights.

- Look for visual aids (Taxiway lights, location information and destination signs).

- Assign crew member to look for and report signs/ markings and keep track of location against the aerodrome chart.

- A crew member who is in doubt or does not agree with the situation must speak-up.

- Expect that ATC will provide 'real-time' significant aerodrome information which may affect operations on or near the runway when NOTAMS and ATIS which are normally used to advise pilots of significant information regarding runway operations are not available.

- Flight Crew must advise ATC on first contact with the Tower if additional time on the runway is required for operational reasons, this might be the case when e.g. in winter an engine run-up for shedding ice could be required.

- 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.

- Do not rush. The higher your ground speed, the less time you have to react, manoeuvre the plane and avoid an obstacle. Avoid being rushed by accepting last minute changes, especially during near runway operations. Time can be your ally and your enemy; use it wisely. Taxi defensively; this is being prepared for the errors of others

Communication

- Check your audio box and volume adjustment whenever a frequency change is made.
- Take extra care accepting a "monitor xxx.xxx frequency" clearance. When after some period this new frequency keeps silent, suspect a wrong entry and refer back to the previous frequency.
- If necessary request progressive taxi instructions.
- Avoid leaving the active ATC frequency. If you need to leave the ATC frequency, then notify your other flight crew members. Afterwards, be briefed by the other crew member of what you have missed.
- The use of Aviation English in a busy and complicated environment should be encouraged, improving situational awareness.
- Speaking slowly is essential when operating in foreign regions. Be proficient with the language used for communication.
- Use standard ICAO compliant radio phraseology at all times. Only strict adherence to standard phraseology avoids miscommunications.
- Read back all runway crossing or hold short clearances using correct radio phraseology.
- Read back, the complete instruction must be read back and must be clear, "Roger" is not a readback. Always include:

  a) Your full aircraft call sign to avoid call sign confusion.

  b) ATC route clearances.

  c) Clearances and instructions to enter, land on, ake-off on, hold short of, cross and backtrack on any runway.

  d) The runway designator to avoid wrong runway selection.

  e) 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.

- Listen to clearances issued to other aircraft. Be extra attentive when another aircraft with similar call sign is on the frequency.
- Both pilots should monitor the frequency and agree upon the acceptance of a clearance to taxi, cross a runway, enter, line up, take-off and land on a nominated runway. Any misunderstanding or disagreement should be cleared up immediately by contacting ATC for clarification: ASK.
- The use of headsets increases the readability of communications with ATC and within the flight deck.
- Ensure all flight crew are on the appropriate frequency until all runways have been vacated after landing.
- After the landing, vacate the runway as soon as possible, but not by turning onto another runway, unless specifically instructed to do so.
- When the aircraft has vacated the active runway, be prepared to stop to resolve any questions about the ATC clearance or about the aircraft position.
- Before commencing after landing procedures, pilots should have received, understood and acknowledged the taxi clearance.

Crossing or entering a runway

- Crossing or entering a runway when cleared to line up and/or when crossing any runway, position the aircraft at a right angle with the runway where possible, in order to better observe the other traffic, both arriving and departing.
- 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 a more extended period, advise about your position and seek clarification: ASK.
- If instructed to follow other traffic, be aware 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 there is any doubt when receiving a clearance or instruction, clarification should be requested immediately from ATC.

- Cancel check list activity when crossing and entering runways. Avoid stopping on a runway unless specifically instructed to do so.

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

REFERENCES

The following ICAO standards are provided to assist flight crews in understanding the use and application of stop bars:

1) **ICAO Annex 2**, Rules of the Air Chapter 3: 3.2.2.7.3 An aircraft taxiing on the manoeuvring area shall stop and hold at all lighted stop bars and may proceed further when the lights are switched off.

2) **ICAO Annex 14** – Aerodromes, Volume 1 - Aerodrome Design and Operations.

3) 5.3.17.9 Selectively switchable stop bars shall be installed in conjunction with at least three taxiway centre line lights (extending for a distance of at least 90 m from the stop bar) in the direction that it is intended for an aircraft to proceed from the stop bar.

4) 5.4.3.35 A taxiway shall be identified by a designator comprising a letter, letters or a combination of a letter or letters followed by a number.

5) 5.4.3.36 Recommendation. When designating taxiways, the use of the letters I, O or X and the use of words such as inner and outer should be avoided wherever possible to avoid confusion with the numerals 1, 0 and closed marking.

6) 5.4.3.37 The use of numbers alone on the manoeuvring area shall be reserved for the designation of runways.

7) **ICAO Annex 15**, Aeronautical Information Services, Chapter 5: 5.3.17.14. Note. A stop bar is switched on to indicate that traffic stop and switched off to indicate that traffic proceed.

8) **ICAO Doc. 4444, PANS-ATM**, 7.13.7 Stop bars. Stop bars shall be switched on to indicate that all traffic shall stop and switched off to indicate that traffic may proceed.

Other References

9) Commission Implementing Regulation (EU) No 923/2012 (SERA) (SERA.3210 Right-of-way and GM1 SERA.3210 (d) (3) Right-of-way.

10) ICAO Annex 11, Air Traffic Services.

11) ICAO Doc. 8168, Procedures for Air Navigation Services – Aircraft Operations, Doc. 8168.

12) FAA. Federal Aviation Regulations / Airman's Information Manual, 2002

13) ICAO NACC Regional office, OPS guidelines for the prevention of runway incursion, Jan Jurek, 2002

14) University of Leiden, Human factors in runway incursion incidents, Patrick Hudson, Netherlands Draft 0_1 v2.0

15) FAA, Runway safety: It's everybody's business, Kim Cardosi, Ph.D., 2001 FAA, Runway Safety Blueprint 2002-2004, 2001 FAA/IATA Runway Incursion Prevention Program.


RWY AHEAD

APPENDIX E
AIR NAVIGATION SERVICE PROVIDER/AIR TRAFFIC CONTROLLER BEST PRACTICES

Memory

Best Practices
- Detecting occupied runway
- Runway Occupancy – Vehicles
- Premature landing/take-off clearance

Coordination

ATS Teamwork and Coordination

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- Application of Team Resource Management (TRM) principles in ANSPs
- Establishing who controls the runway
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- Transfer of departure traffic

Situational Awareness

Best Practices
- Promote a sterile control room concept
- Support Pilot Sterile Cockpit SOP
- Visual recognition of Hot Spots
- Work in progress
- Visual scanning techniques
- Continuous Watch of Aerodrome Operations ('Heads Up'/ 'Heads Down')
- Managing vehicles on the manoeuvring area

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Planning and Decision Making Process

Miscellaneous
- Runway Crossing
- Why Stop Bars?
- Stop Bar Contingency Measures
- Training (in Runway Incursion prevention)
- ATC Visual Lines of Sight (Controller 'blind spots')

APPENDIX E

AIR NAVIGATION SERVICE PROVIDERS AND AIR TRAFFIC CONTROLLER BEST PRACTICES AND GUIDANCE MATERIAL

Most of the proposed recommendations and best practices are already widely implemented. Others have found a minor application for various reasons: rigidity of the systems, existing procedures, national or local constrains, concerns about their effects on traffic capacity or air traffic controller workload and available technology.

ANSPs and air traffic controllers should carefully consider the potential positive effects on the overall safety of each recommendation and best practice and, in case of uncertainties, assess them by virtue of their actual influence and applicability at local level and not just consider them as a 'one-size-fits-all' solution.

Furthermore, ANSPs may consider raising the rank of some recommendations into a mandatory provision and transposing them in their operational manuals.

Most typical runway incursion scenarios:

- Taking-off or landing on a runway that is already occupied;
- Entering a runway for which another aircraft has received a take-off or landing clearance;
- Two aircraft departing/landing on intersecting runways;
- Runway crossing after an aircraft has received a take-off or landing clearance;

Several studies have focused on the types of Controller error that can contribute to runway incursions. The findings converge on several key points; the most common are related to:

1. **MEMORY:** Forgetting about an aircraft, the closure of a runway, a vehicle on the runway and/or a clearance that has been issued;
2. **COORDINATION:** Inadequate coordination between Controllers, hand over process, poor TRM;
3. **SITUATIONAL AWARENESS:** Misidentifying an aircraft or its location, insufficient visual scan;
4. **COMMUNICATION:** incomplete, incorrect, ambiguous or complex RTF, hear-back inaccuracies, misapplication of conditional clearances;
5. **PLANNING AND DECISION MAKING PROCESS:** Incorrect ATC clearance, bending the procedures, providing insufficient separation and trying to be over-expeditious.

All these key points are closely interconnected: forgetting something, lack of clarity in communications, underestimating the handover or missing timely information may undermine situational awareness.

Thus, many of the air traffic controller recommendations cover - at the same time - more than one facet of operations and support improved situational awareness and correct decision making by all stakeholders involved in runway operations.

Runway incursions events, in most cases, come from a combination of the above mentioned factors and in which environmental characteristics such as airport layout, procedures and behavioural habits may play an important part in inducing a runway incursion.

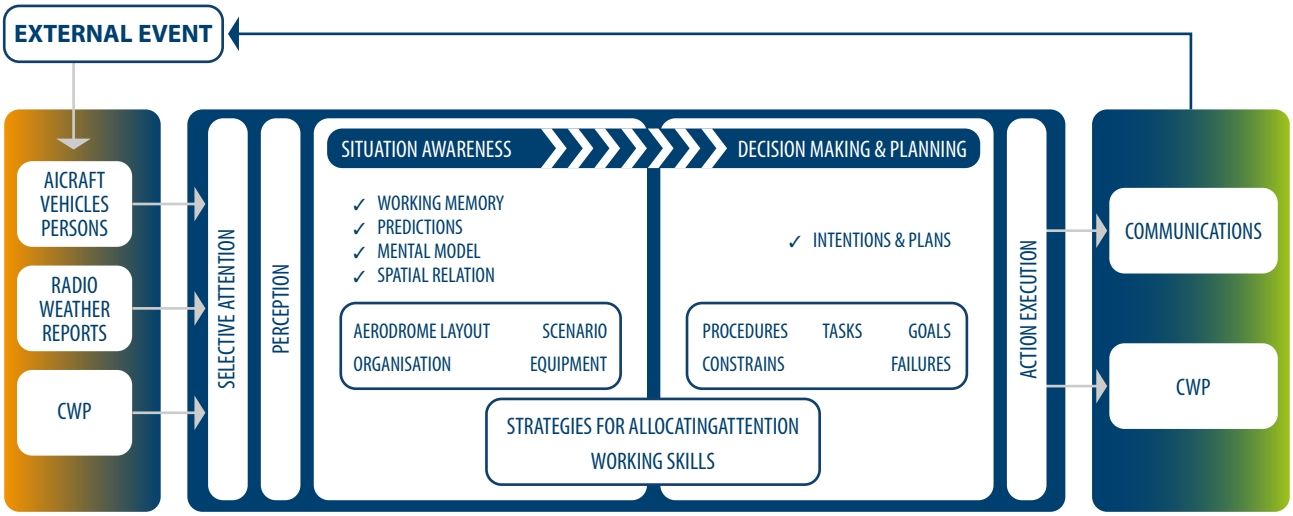

Fig 1: Basic air traffic controller cognitiveprocess

Keeping this in mind, it is important also to recognise when procedures are introduced in order to temporarily mitigate an existing internal or external problem (for example a 'hot spot' on the aerodrome) that, eventually, should be eliminated through a long-term solution to remove the underlying risk.

MEMORY

ANSP Recommendations:
1.5.1, 1.5.2 e/g/h/i/j, 1.5.3, 1.5.4, 1.5.6 b, 1.5.14.

Memory can be defined as the ability to store, retain, and subsequently recall information. It may involve conscious and unconscious aspects.

Aerodrome traffic control includes observing and reacting to events that take place on the manoeuvring area based on interpretation of information acquired visually, displayed at the working position or received through voice communication.

Memory plays an important part in this process because of the large amount of information reaching the Controller. It is therefore necessary to manage this data in such a way that they are not missed, forgotten, or overlooked. Techniques, procedures and the disciplined use of memory aids can support Controllers in the task.

BEST PRACTICES

a. Detecting an occupied runway:

ANSPs shall provide memory aids, surveillance systems and integrated solutions for the purpose of detecting and alerting ATS units when a runway is occupied.

Controllers should follow strict local procedures related to the recording and display of the information regarding an occupied runway (either via a paper/electronic strip bay or via other established means and procedures (such as 'blanking' the anemometer/wind dials).

The effectiveness of any of these measures highly depends on operational procedures and, obviously, strict Controller adherence to them. If, for any reason, Controllers decide to postpone the use of the available aids or rely solely on memory, the chances to forget things are increased.

Electronic flights strips (EFS) may help in mitigate the above issue by autonomously triggering the runway engaged status every time, for instance, a vehicle strip is moved into the appropriate runway bay. Flight Progress Board (FPB) should be designed to have only ONE position for placing aircraft and vehicle when cleared "on the runway" (as opposed to some EFS Boards that have separate bays for departure and arrival on the same runway).

Further Reading:
EUROCONTROL SISG Operational Safety Study:
Controller Detection of Potential Runway and Manoeuvring Area Conflicts Ed. 1.0 – 2015.

b. Runway Occupancy – Vehicles:

ANSPs should introduce and promote procedures to support Controllers in performing memory related tasks and increase overall situational awareness when vehicles occupy a runway. This is particularly important when there are multiple vehicles on the runway and one vehicle reports vacating, but the runway is still occupied. Other actions can include:

- During runway inspections, request vehicle drivers to call out progress checkpoints (like "1st third checked", report abeam taxiway D, etc.);
- Provide runway inspection clearances using partial/progressive clearances in order to be called out by drivers;
- For long inspections or busy context, request vehicle drivers to call out every few minutes ("Vehicle Operation Normal"). This time limit should be specified locally but, ideally, should not exceed 5 minutes.

Further Reading:
See also Appendix L, Aerodrome Operator – Maintenance, Inspections and Works in Progress/Temporary Modifications of the Aerodrome.

c. Premature landing/take-off clearance:

Controllers are generally accustomed to issuing the landing clearance at the first logical opportunity so they can mentally move on to the next required sequence of actions. For example, this happens often during low traffic situations when landing clearance might be issued on receipt of the first aircraft call (even if at 15NM on final).

Similarly, line-up and/or take-off clearance are sometimes issued very early and so far away from the runway regardless of ICAO Doc. 4444 PANS-ATM provisions on the matter (§ 7.9.3.3 and 4).

Such an early passing of line-up and/take-off or landing clearance, which may not have any capacity related benefits, has been a contributing factor in several serious runway incursions. This practice makes Controllers more prone to memory lapses because of possible changes in the operational scenario (new traffic calls or calls for runway inspections, handover, phone coordination, critical incoming operational matter, …).

Proper timing in issuing clearances is a crucial element for maintaining situational awareness; emerging tool functionality such as conflicting ATC clearances on electronic flights strips (EFS) systems can provide an effective mitigation.

ANSPs may establish at airports, as local best practice or mandatory procedure, a distance from threshold where the landing clearance should be normally issued and publish this information in AIPs to make pilots aware of it.

For instance: Where the landing rate is expressed in terms of minimum distance between succeeding arriving aircraft (5 NM) the landing clearance shall not be issued earlier than 5NM from threshold and the controller may inform pilot : " XXX 123 number 1, continue approach RWY 35 expect landing clearance at 5 miles on final".

COORDINATION

ANSP Recommendations:
1.5.1, 1.5.2 d/e, 1.5.3, 1.5.4, 1.5.5, 1.5.6, 1.5.7 & 15.14.

ATS Teamwork and Coordination

The ATS system relies on good teamwork to achieve its goals.

Inadequate coordination between the Ground Controllers (GND) and Aerodrome Controllers (TWR) or between different controlling positions can cause a runway incursion, mainly due to:

- Possible misinterpretation of a situation when a runway is occupied by more than one participant: e.g. an aircraft and a vehicle managed on different frequencies by different controllers;
- Runway Configuration Change/Status: who isresponsible for the runway?

In all these cases procedures shall state clearly:

- Areas of responsibility, avoiding overlaps.
- That where control of taxiing aircraft is provided by a GND Controller and the control of runway operations by an Aerodrome Controller, the use of a runway by taxiing/crossing aircraft shall be coordinated with, and approved by, the Aerodrome Controller. Moreover, communication with the aircraft concerned should be transferred from the GND Controller to the Aerodrome Controller prior to the aircraft entering the runway.
- Where circumstances do not permit the use of a single VHF frequency for aircraft and vehicles, for runway operations, the GND Controller or the TWR Coordinator must obtain an explicit approval from the Aerodrome Controller before clearing a vehicle to enter or cross an active runway. The Aerodrome Controller should be the person responsible for the correct recording and displaying of the runway engaged status.

BEST PRACTICES

a. Application of Team Resource Management (TRM) principles in ANSPs:
Strategies are available to ANSPs to make the best use of all available resources - information, equipment and people - to optimize the safety and efficiency of Air Traffic Services. Team Resource Management (TRM) enhances Controllers' understanding of the sources of error in ATC and helps them to develop personal strategies to reduce error and to mitigate consequences. TRM can also help raise awareness of fatigue and unusual activity/behaviour of colleagues. In this way TRM supports operational safety efforts and aims to reduce human error also by dynamically delineating roles and establishing effective cross-checking procedures within a team such as the 'professional challenge' adopted by some ANSPs.

Further Reading: EUROCONTROL Guidelines for TRM Good Practices, Ed. 1.1 – 2015

b. Establishing who controls the runway:
Phraseology adapted from proven pilot CRM (Crew Resource Management) concepts such as: "My Runway / Your Runway" during, for instance, aerodrome configuration change can improve coordination between controllers and establish who has control of the runway(s).

c. Hand-over/Take-over:
It is apparent that a number of runway safety occurrences take place soon after a Controller handover, either of the operational watch or a single operational position. Controllers shall ensure that the complete traffic situation on the runway has been passed on and understood; to complement this process, the use of handover/takeover (HOTO) checklists, with runway status listed last, should be encouraged. Furthermore, handover/takeover shall be postponed every time critical tasks need to be completed.

d. Transfer of departure traffic:
At some aerodromes transfer of departure traffic from the Ground Controller to the Aerodrome Controller are suspended during runway inspections or configuration changes until the inspection/change is complete.

SITUATIONAL AWARENESS

Recommendations: All ANSP

For a Controller, situational awareness means mainly acquiring and maintaining a mental picture of the traffic situation considering all the potential unexpected progressions or changes in the scenario. It also involves projecting that mental picture into the immediate future and can create an expectation about what is going to happen next.

The controller's working environment and procedures should be designed to help in maintaining the situational awareness keeping in mind that ATC procedures and controller behaviour influence, also, pilots' and drivers' situational awareness.

BEST PRACTICES

a. Promote a sterile control room concept:
Interruptions (e.g., due to phone calls, non-standard events and communications) and distractions (e.g., loud conversations, ambient noise, presence of external staff, smartphone, etc.) do occur. Some cannot be avoided and therefore must be coped with by the Controllers. Others can be minimised or eliminated through training, adoption of effective procedures, discipline and the use of good judgment. If the number of interruptions and distractions is not minimised or the impact of residual interruptions and distractions is not controlled, safety can be affected. In accordance with the principles of TRM, air traffic controllers that feel they are been distracted by non-operational factors should feel able to voice their discomfort.

b. Support Pilot Sterile Cockpit SOP:
There is a link between runway incursions or other ground navigation error and clearances or amended clearances being passed whilst aircraft are taxiing, backtracking or lining-up.

There is a **BEST TIME FOR ISSUING ATC CLEARANCES**.

Best practices and procedures encourage Controllers to pass clearances and information before the pilot begins to taxi; if a late-notice tactical change to the clearance has to be issued when the aircraft is close to the runway, the following procedure shall be followed to avoid possible confusion:

When an aircraft is at the holding position or on the runway, ATC should always use the phrase, "HOLD POSITION" before passing a revised clearance, this is to ensure that the pilot has no doubt that the ATC communication does not constitute a clearance to line-up, take-off or cross.

c. Visual recognition of Hot Spots
In some tower control rooms, photos of the manoeuvring area and/or hot spots (taken from different heights/perspectives) are displayed near to the controller working position and/or in the local Operation Manuals. This information can help air traffic controllers improve their situational awareness by imagining what a lost pilot or driver could be seeing.

d. Work in progress
Work in progress may change the surface of the aerodrome temporarily or permanently; the infrastructure left behind at the end of the shift, may be different on return. ANSPs should know about all changes well in advance as these should be published by NOTAM/AIP. Consequently, ANSPs can assess the impact of works on the movement area and properly inform Controllers who should expect to provide 'real-time' significant aerodrome information to pilot via R/T and/or ATIS.

Further Reading:
See also Appendix L, Aerodrome Operator – Maintenance, Inspections and Works in Progress/ Temporary Modifications of the Aerodrome.

e. Visual scanning techniques: In more than half of the analyzed Sudden High Energy Runway Conflict (SHERC) events in the EUROCONTROL Operational Safety Study, ATC did not visually detect the potential conflict prior to the runway incursion: the best practice of a proper and systematic visual scan of the entire runway and approach area, in both directions, can be one of the most effective safety barriers to stop an event.

Anyone can "look", but scanning is more than just looking. Scanning is the skill of seeing by looking in a methodical way.

Fig 2: Sample of a Vehicle Progress Strip

Glancing out without stopping to focus on anything is of limited value as is staring out into one spot for long periods of time. Scanning is not limited to the external view but must also incorporate a structured search inside the visual control room at supporting systems such as weather and surveillance systems, EFS, etc.

Learning how to scan properly by knowing where and how to concentrate the search requires training and the constant sharing of attention with other Controller tasks.

f. Continuous Watch of Aerodrome Operations ('Heads Up'/ 'Heads Down')

Recommendation 1.5.13c states that "controllers shall develop procedures to ensure that, as far as practicable, controllers are 'heads-up' for a continuous watch of aerodrome operations." Whilst this implies a predominantly 'eyes outside' style of controlling, in the context of modern ATC VCRs and the increasing amount of technology that is available to assist the controllers, the recommendation also recognises that controllers will, inevitably, spend some time 'heads down' . A structured, methodical scanning technique will help controllers integrate 'heads down' tasks with the need to maintain a 'heads up' posture; the combination results in the 'continuous watch' of aerodrome operations.

ANSPs should, therefore, reinforce, on a regular basis, the fundamental importance of an aerodrome control visual scan (both inside and outside the window) and train controllers in techniques that can help to develop and maintain this skill.

Further Reading:

EUROCONTROL SISG Operational Safety Study: Sudden High Energy Conflict (SHERC) Ed. 1.0 – 2017

g. Managing vehicles on the manoeuvring area:

Current ICAO Doc. 4444 PANS-ATM at § 7.12.6 and its forthcoming transposition into EU law, prescribe the recording of vehicles during operations in low visibility conditions. ANSPs should consider establishing this provision in all visibility conditions and manage vehicles - on the manoeuvring area – through, for instance, the use of progress strips as done with aircraft in order to easily improve situational awareness and detect possible conflicts.

h. Runway access points for vehicles:

Some runway incursions are attributed to vehicles entering runways other than by via designated vehicle entry points (e.g. taxiway or road). Where designated access points are used, a stop bar or a road-holding position marking and light often provide an additional layer of protection. It is acknowledged, however, that using designated vehicle entry points may not be operationally feasible in all circumstances e.g. when runway inspection, wildlife control or rescue/ fire fighter vehicles require immediate access to the runway in the course of their duties.

COMMUNICATION

ANSP Recommendations:
1.5.1, 1.5.2 a/b/c/d/e, 1.5.6 b, 1.5.7, 1.5.8.

Voice radio telephony (R/T) communication at airports is frequently cited as a causal or contributory factor to runway incursions.

Voice communication that works effectively in low traffic situation is sometimes strained to the breaking point during peak traffic periods. It is during these times that Controllers may not be able to communicate with pilots in the way ATC-pilot communication loop was designed to work. This can lead to an unwelcome and unintentional reduction of safety measures such as proper timing of transmissions and readbacks/hearback to accommodate more ATC instructions onto the crowded frequencies. Yet these are the scenarios and circumstances where the consequences of inaccuracies or omissions may be more critical, and where robust safety measures are most needed.

Further Reading:
Appendix A, Communications Guidance provides a more detailed elaboration of the factors that Controllers, pilots and drivers should follow in order to preserve strong R/T safety standards that can help to prevent runway incursions. In addition, the following communications related areas are highlighted.

BEST PRACTICES

Taxi Instructions
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 position of the runway in use, but it may be any other position on the aerodrome depending on prevailing traffic circumstances. When a taxi clearance contains a taxi limit reporting point 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.

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.

Standard taxi routes simplify taxi instructions and help to reduce the likelihood of communication errors and confusion on or near the runway; consequently, it is strongly advisable to use standard taxi routes.

Pilots require a general overview of the expected taxi routing. 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, while providing the complete picture.

Conditional Clearances
Conditional clearances, when justified, can help to improve the flow of traffic on and around aerodromes but only where they are accompanied with the most stringent voice communication discipline. The ICAO provisions for the use of Conditional Clearances are described in Appendix A, Communications Guidance which also advises ANSPs to assess their continued use and consider if they can be removed or reduced.

Further Information:
A SKYbrary SKYclip covering Conditional Clearances can be viewed at:
http://www.skybrary.aero/index.php/Conditional_Clearance_(SKYclip).

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

Further guidance on the critical operational importance of the readback/hearback communication loop is provided in Appendix A - Communications.

Further Reading:
See more in Appendix A, Communication Guidance.
See SKYbrary SKYclip covering Readback-Hearback at: https://www.skybrary.aero/index.php/Solutions:SKYclips

PLANNING AND DECISION MAKING PROCESS

Recommendations:
1.5.1, 1.5.2 d/f/g/h/i/j/k, 1.5.3, 1.5.4, 1.5.7, 1.5.9, 1.5.14.

The decision making process is vulnerable when information is incomplete, conflicting or unreliable, or when goals conflict. Decision making may be improved by training and strategies that do work well in real-world environments. Training, for example, may sensitise Controllers to trade-offs among speed, accuracy, and task prioritization; in addition, it may foster techniques for identifying and correcting problems, understanding and planning. For instance, Controllers may learn to recognize gaps in their knowledge of relevant information, conflicts in the data, or unreliable assumptions.

MISCELLANEOUS

Runway Crossing ANSP Recommendations:
1.5.1, 1.5.2 b/c/g/j, 1.5.3, 1.5.4, 1.5.7, 1.5.8, 1.5.9, 1.5.10,1.5.14

If an aerodrome is designed so that there is no need for aircraft or vehicles to cross an active runway, then the risk of this type of incursion is confined to discretionary use by ATC of such clearances and any active runway crossing clearance should be regarded as of equivalent significance to a take-off or landing clearance.

The relative risk of collision at a central intersection is higher than the risk inherent in crossing at the end of the runway; where circumstances permit, runway crossing clearances should be given as near to either end of a runway as possible and, where this is not possible, at least full length take-offs should be preferred for departing aircraft.

When time is critical, Controllers should consider informing the crossing aircraft/vehicle of traffic which will subsequently land or take-off on the same runway. Simultaneous runway crossings should be discouraged except when all parties involved agree and traffic information is provided. Other phraseology associated with runway crossings is provided in Appendix A, Communications Guidance. Aerodrome design considerations to reduce the amount of runway crossings are explored in Appendix K.

Electronic flights strips (EFS) may help in raising situational awareness when an aircraft is crossing a runway if, when clearing it, the system will turn automatically into a runway engaged/occupied status.

Note: *EASA GM1 ADR – DSN.M.745 states that "Active runway is to consider any runway or runways currently being used for take-off or landing. When multiple runways are used, they are all considered active runways."*

Why Stop Bars?

The provision of stop bars at all Runway Holding Positions and their use at night and in all visibility conditions can form part of effective runway incursion prevention measures.

Stop bars are installed to provide protection at runways and reduce the risk of runway incursions through:

- Enhanced visibility of Runway Holding Positions.
- Reinforcing the control of aircraft and vehicles in the vicinity of the runways.
- Minimising the risk of aircraft or vehicle identification error.
- Minimising the risk of ATC clearances being misinterpreted.
- Enhancing safety during low visibility conditions.

Pilots and vehicle operators are required to stop at the Runway Holding Positions and obtain clearance from ATC prior to entering a runway; clearance to enter the runway by ATC should be issued in the following sequence:

1. ATC Aerodrome Controller shall extinguish the stop bar lights
2. Once the stop bar lights have been extinguished, ATC will issue the pilot or vehicle with the appropriate clearance.

Note: *This should happen almost simultaneously*

Ideally, stop bars would be installed at all Runway Holding Positions and used H24 irrespective of weather and/or environmental conditions. There are, however, various reasons why an airport, where stop bar are already installed, do no use them H24. The main concerns are:

- Air traffic controllers' workload: The use of stop bars requires ATC manual actions through the lighting control interface in the control tower, these actions are sometimes considered as additional workload to the normal ATC procedures, particularly where the lighting control interface has not been designed efficiently. The solution is an effective interface where stop bars that protect the runway should be individually selectable with a single input by the runway controller at his/her own working position.

- Stop bars are installed only at CAT II/III Runway Holding Position

Electronic flights strips (EFS) can provide a method of stop bar control that could alleviate ATC workload constraints combining, for instance, the issuing of the line-up clearance with the extinguishing of the stop bar lights and/or a minimal stop bar control panel in the EFS display.

ANSPs, in conjunction with Airport Operators, shall provide a clear policy for the use of stop bars and related contingency procedures. Recommendation 1.5.10d states that an aircraft shall not be instructed to cross illuminated stop bars when entering or crossing a runway unless contingency measures are in force. The objective of this recommendation is to maintain the integrity of the stop bars, which are intended to protect the runway at any airport the pilot may fly to.

Stop Bar Contingency Measures

ANSP Recommendation: 1.5.10c

(From GM1 SERA.3210 (d) (3) Right-of-way)

"When considering contingency arrangements for situations where the stop bars cannot be turned off because of a technical problem, the air traffic service provider should take into account that such contingency arrangements should significantly differ from normal operations and should not undermine the principle that a lit stop bar must not be crossed.

The service provider may consider, inter alia, the following:

(a) physically disconnecting the respective lit stop bar from its power supply;

(b) physically obscuring the lights of the lit stop bar; or

(c) providing for a marshaller or a follow-me vehicle to l ead the aircraft to cross the lit stop bar."

In addition, stop bar contingency plan may include closing the taxiway where the failure happened and using an alternative, suitable runway holding position equipped with a functioning stop bar. Exceptionally, ATC may instruct pilot to cross/enter the runway with a specific clearance given by ATC to cross an illuminated stop bar due to a malfunction of the system and a specific read back of crossing an illuminated stop bar due to a malfunction of the system.

Further Information:

See SKYbrary SKYclip covering the use of Stop Bars at: http://www.skybrary.aero/index.php/Stopbars_(SKYclip).

Training

ANSP Recommendations: All ANSP

Runway Safety issues should be included in team briefing or debriefing sessions that may occasionally be held at unit level, as part of a lesson learning process; this should include not only the scenarios that have led to actual runway occurrences, but also other situations that almost resulted in a runway incursion.

Air Traffic Controller training ab-initio syllabus and refresher courses should include at least information about:

1. Runway incursion causal and contributory factors.

2. How to prevent runway incursions.

3. Lessons learnt (e.g. via runway incursion case studies affecting own or other aerodromes.

4. Visual scanning techniques (outside and inside the visual control room).

Adequate practical training should follow theoretical training in runway safety procedures.

Note: *Runway incursion training awareness is a requirement of Regulation (EU) No 2015/340.*

ATC Visual Lines of Sight

ANSP Recommendations: 1.5.11 and 1.5.12

Notwithstanding the introduction of new technologies and functionalities that can sometimes promote a 'heads down' posture, Aerodrome control still requires controllers to 'look out of the window' and maintain a continuous watch on aerodrome operations as far as is practicable (i.e. it is impractical during reduced visibility conditions where the use of technologies can assist the controller to control traffic on and around the aerodrome).

Impairment or infringement of controllers' visual lines of sight, in particular to runway thresholds, intersections, crossing points, 'hot spots' and approaches, can compromise the fundamentals of the 'heads up, eyes outside' main nature of aerodrome control.

ANSPs, in consultation with aerodrome operators, should assess visual sight lines from the VCR and existing visibility restrictions which have a potential to limit the controller's view of the runway. Known controller 'blind spots' can be depicted on AIP aerodrome/hot spot charts. In addition, aerodrome surveillance systems (e.g. A-SMGCS), cameras and other sensors (similar to those being introduced to implement 'Remote Tower' operations) can be used to mitigate controller 'blind spots'. Temporary restrictions in visibility from the VCR, due for instance to work in progress, shall be treated in the same way as permanent ones.

Longer term solutions could include changes to procedures, technological implementations or re-positioning of the facility/CWP to ensure the best possible solution within the limitations of the airport layout.
An extract from an aerodrome chart highlighting the areas not visible from ATC can be seen below. See also Appendix K.

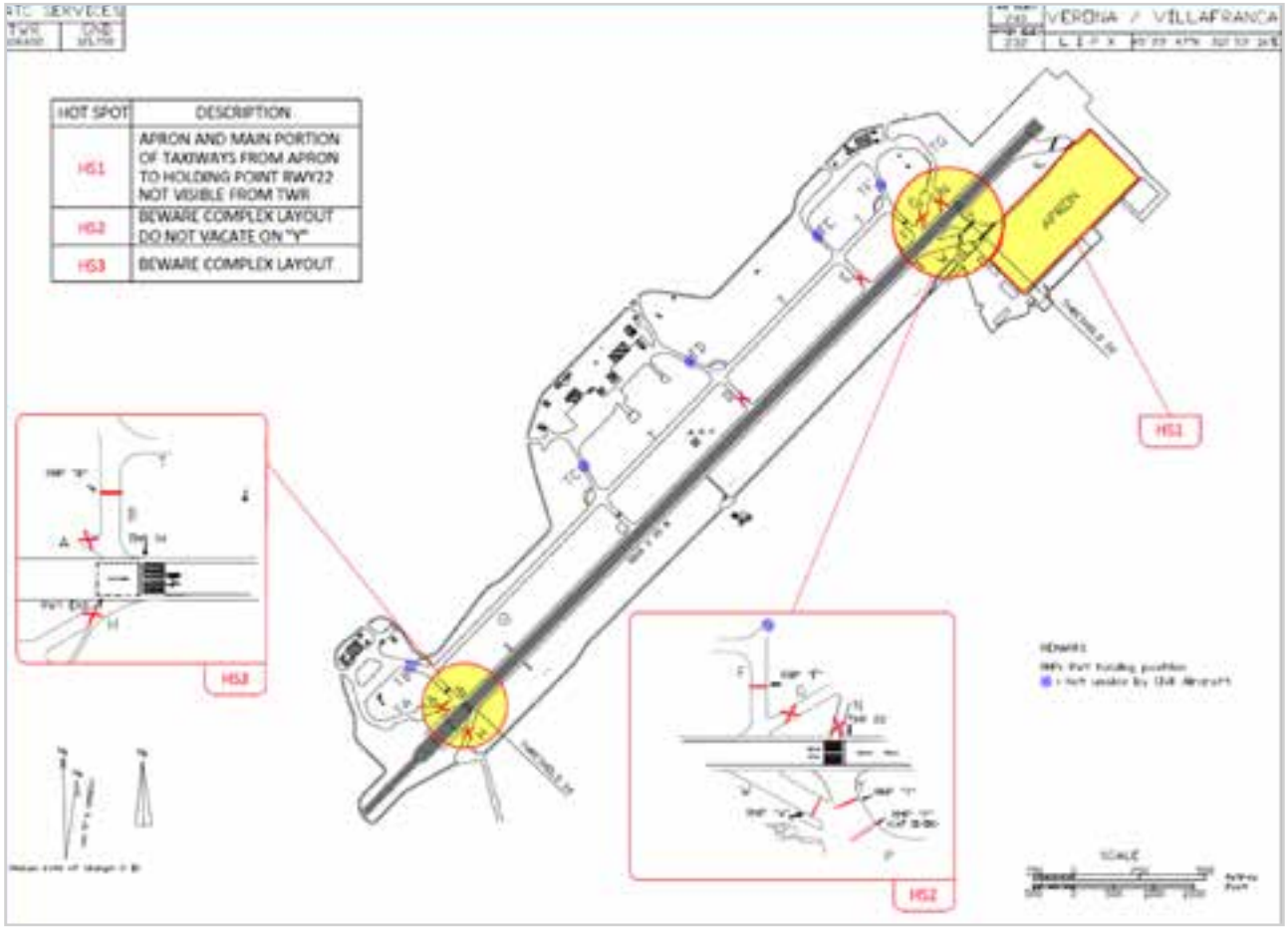

Fig 3: Aerodrome chart highlighting the areas not visible from ATC (HS1).

APPENDIX F
OVERSIGHT ACTIVITIES FOR REGULATORS

Safety Regulatory Audits and Inspections

National Runway Safety

Support and Promotion of EAPPRI

APPENDIX F OVERSIGHT ACTIVITIES FOR REGULATORS

Effective oversight of runway and aerodrome operations forms an important part of the safety management system (SMS) of the aerodrome operator, air navigation service provider, other stakeholders and of the State Safety Program activities.

EU, ICAO and national obligations place responsibilities on States to ensure safety, regularity and efficiency of aircraft operations at aerodromes under their jurisdiction. Therefore, it is essential that the State retains its overseeing responsibility and ensures that the aerodrome operator, whether or not the aerodrome operator is state owned or private, complies with the relevant ICAO SARPs and/or applicable EU or national regulations.

For the Regulator this may be partly achieved by implementing an aerodrome certification procedure to certify an aerodrome through the approval of the aerodrome manual and acceptance of their SMS. For air navigation service providers and other stakeholders a similar certification process should be in place.

SAFETY REGULATORY AUDITS AND INSPECTIONS

The Regulators should conduct safety regulatory audits and inspection on aerodromes operations to monitor and assess the level of safety achieved.

The regulatory oversight of aerodrome operators may include:

- Ensuring that an aerodrome has an effective runway incursion prevention programme that meets ICAO or EU or national requirements;
- Joint/coordinated audits and inspections to examine the interfaces between the aerodrome agencies involved in runway incursion prevention; e.g. coordination between ATC, aircraft operators, aerodrome operators and contractors during aerodrome work in progress;
- Reviewing the airside driver training programme to ensure the adequacy of driver training for the staff of all organisations operating airside;
- Reviewing Low Visibility Procedures (LVP) from a runway incursion perspective;
- Reviewing incident prevention programmes, including occurrence reporting relating to runway incursions;
- Reviewing aerodrome design changes, including vehicular traffic routes that intersect runways and taxiways;
- Reviewing runway safeguarding, including entry and exit points, runway, taxiway holding points, stop bars, illuminated signs and lights;
- Reviewing procedures for third party contractors during any work in progress on the manoeuvring area;
- Reviewing the work program of the aerodrome local Runway Safety Team with reference to the European Action Plan for the Prevention of Runway Incursions.

RISK-BASED OVERSIGHT

In the frame of the introduction of Risk-based oversight (see the EASA document "Practices for risk-based oversight") within the audits and inspections planning process of regulators, the regulator can adapt the oversight burden for an operator with regards to:

- Its intrinsic risk exposure to runway incursions;
- Its safety performance regarding runway incursions.

That is to say the means that the operator puts in place in order to reduce the runway incursion risk as far as is practicable. If the operator is intrinsically exposed to runway incursions and/or has a poor or weak runway incursion risk regime, the regulator might intensify the oversight on one or several points exposed above. On the other hand, if the operator has no runway incursion problem, the oversight burden might be relaxed.

NATIONAL RUNWAY SAFETY

In addition to the regulatory oversight described above, it may benefit a regulator to keep a high level, national focus on the risk of runway incursions. This can be achieved by establishing a national runway incursion prevention steering group. Membership of the group could include representatives from industry such as aerodromes, airline flight operations, air traffic services, industry safety groups, aerodrome local Runway Safety Team members and appropriate representatives from the regulatory authority.

Terms of reference for such a group might be to:

- Address specific hazards identified nationally, coordinating this through sub-groups or external agencies as required.
- Promote good practice, share information and raise awareness through publicity and educate industry.
- Actively enhance work continuing in industry.
- Act as a coordination point for industry.
- Identify and investigate which technologies are available that may reduce runway incursion risks.
- Review current aerodrome, ATC and aircraft operational policies and if necessary make recommendations on future policy to reduce the risk of incursions.
- Make recommendations for guidance and advisory material for industry on aerodrome, aircraft and ATC operational issues to reduce the risk of incursions.
- Oversee and promote the reporting of runway incursion incidents.
- Ensure the thorough analysis of data to identify and examine specific areas of concern.

SUPPORT AND PROMOTION OF EAPPRI

Regulators should actively support and promote the European Action Plan for the Prevention of Runway Incursions as part of the State Safety Program activities. Although the action plan is guidance material and contains recommendations only, regulators should ensure that it is given a continuous priority in its oversight activities wherever possible by:

- Promoting awareness of the European Action Plan for the Prevention or Runway Incursions guidance material.
- Conducting a gap analysis to ensure that all recommendations are implemented where possible.
- Ensuring that runway safety and the prevention of runway incursions are addressed in regular audit inspections.
- Ensuring that the recommendations arising from audits are implemented wherever possible.

REFERENCES

1) Commission Implementing Regulation (EU) No 1034/2011 on safety oversight in air traffic management and air navigation services

2) Commission Regulation (EU) No 1035/2011 laying down common requirements for the provision of air navigation services

3) Commission Implementing Regulation (EU) No 2017/373 laying down requirements for service providers and the oversight in ATM/ANS (applicable January 2020)

4) Commission Regulation (EU) No 139/2014 laying down requirements and administrative procedures related to aerodromes

5) EASA document "Practices for risk-based oversight"

POLICIES
PROCEDURES

APPENDIX G
SAFETY MANAGEMENT SYSTEMS

General definition

The international SMS framework

Safety management systems guidance materials

Risk based, data driven systematic approach to safety

Assessing the effectiveness of SMS implementation

APPENDIX G SAFETY MANAGEMENT SYSTEMS

GENERAL DEFINITION

A Safety Management System (SMS) is a management tool for the management of safety by an aviation undertaking[1], aimed at ensuring that safety is managed systematically and consistently. In summary, safety management:

- includes the entire operation;
- focuses on processes, making a clear differentiation between processes and outcomes;
- is data driven;
- involves constant risk-based monitoring;
- is strictly documented;
- aims at gradual improvement as opposed to dramatic change; and
- is based on strategic planning as opposed to piecemeal initiatives

THE INTERNATIONAL SMS FRAMEWORK

ICAO

ICAO Annex 19 (Safety Management) consolidates the overarching safety management SARPs on safety management relating to aircraft operators, air navigation service providers and aerodromes which had previously been detailed in Annexes 6, 11 and 14 respectively.

To support the Annex 19 SARPs, ICAO Doc. 9859 (Safety Management Manual) aims to harmonise SMS implemented in the aviation sector. ICAO recommends a framework for the implementation and maintenance of a SMS by an organisation. The implementation of the framework should be commensurate with the size of the organisation and the complexity of the services provided.

EU

Within Europe, requirements for safety management systems are contained in European Union (EU) "Common Requirements"

- Commission Implementing Regulation (EU) No 1034/2011 on safety oversight in air traffic management and air navigation services
- Commission Regulation (EU) No 1035/2011 laying down common requirements for the provision of air navigation services.
- Commission Implementing Regulation (EU) No 2017/373 laying down requirements for service providers and the oversight in ATM/ANS (applicable January 2020).
- Commission Regulation (EU) No 139/2014 laying down requirements and administrative procedures related to aerodromes, specifically ADR.OR.D.005.
- Commission Regulation (EU) No 965/2012 on Air Operations.

EUROCONTROL

In addition, ESARRs (EUROCONTROL Safety Regulatory Requirements), apply to some non-EU EUROCONTROL States. Namely:

- ESARR3 Safety Management Systems in ATM and its related guidance material;
- ESARR4 Risk Assessment and Mitigation in ATM and its related guidance material.

1. *The term "aviation undertaking" refers to any organisation providing aviation services. The term thus encompasses air traffic service providers and certified aerodromes as well as approved training organisations that are exposed to safety risks during the provision of their services, aircraft operators, approved maintenance organisations, organisations responsible for type design and/or manufacture of aircraft, as applicable.*

SAFETY MANAGEMENT SYSTEMS GUIDANCE MATERIALS

RISK BASED, DATA DRIVEN SYSTEMATIC APPROACH TO SAFETY

Complimentary to core SMS activities, evolving safety thinking is to move from an events-based approach to safety (including runway safety) to a comprehensive data-driven, risk-based approach. In so doing, more focus will be given to proactive, leading safety indicators and other systemic issues (related to the prevention of runway incursions) and will supplement the traditional, reactive approach to safety. A change of approach that shifts the focus from "what went wrong" to an analysis of "what went right" can provide valuable insights and a better understanding of the everyday (positive) things that contribute towards safe operations rather than a reliance on the still relatively few occurrences that have a negative impact on safety.

Note: *The EUROCONTROL documents, "From Safety I to Safety II – A White Paper" and "Systems Thinking for Safety: Ten Principles A White Paper – Moving Towards Safety II" provide more information about this approach. These documents should be addressed only for the aviation undertakings whose SMS have already reached an excellent maturity level.*

ASSESSING THE EFFECTIVENESS OF SMS IMPLEMENTATION

To assess the effectiveness of their SMS implementation regarding runway incursions, aviation undertakings should at least focus on the following SMS related issues:

- **Change management:**
  The aerodrome operator and the local air navigation service provider should take special attention while conducting changes on the platform that have an impact on runway safety. While conducting the safety impact assessment study, a representative subset of the relevant actors on which the change has an impact should be included in the team in charge of its elaboration. These actors include when relevant the platform's users and the ground handlers. Furthermore, the aerodrome operator and the local air navigation service provider should ensure that all the measures decided in the safety impact assessment study are effectively in place.

- **Just culture:**
  The aerodrome operator should ensure that just culture is in place among the subcontractors that operate works that have an impact on runway safety.

- **Occurrences management:**
  The analysis of a serious occurrence related to runway safety should be systematically conducted by the aviation undertakings. Furthermore, when actions related to this analysis are decided, a control loop assessing the effective implementation of these actions should be present in the SMS of the concerned aviation undertaking.

- **Interfaces management:**
  The aerodrome operator and the local air navigation service provider should have contacts with a representative subset of the relevant stakeholders that have an impact on runway safety, including the subcontractors and the platform's users. Particularly, a representative subset of platform's users should actively participate to the aerodrome local Runway Safety Team (RST) meetings.

- **Communication/Training:**
  The aviation undertaking should ensure that all the stakeholders that have an impact on runway safety are aware and trained to address runway safety issues.


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APPENDIX H
AERONAUTICAL INFORMATION MANAGEMENT

Manage Aerodrome Information

NOTAM and AIP Supplement

Data Quality Management

Data Consistency and Completeness

Single European Sky Regulation

Post-Flight Information

Designation and Publication of Hot Spots in States AIP

Digital Aeronautical Information Management

Interoperability from Original Data Source to End User

APPENDIX H
AERONAUTICAL INFORMATION MANAGEMENT GUIDANCE

Accurate aerodrome charts providing relevant information for the pilot, manoeuvring area driver and aerodrome controller is fully acknowledged as an important contributor to the prevention of runway incursions. Errors contained in aerodrome charts have led to a loss of situational awareness and ground navigation errors by pilots and have been documented in runway accident reports.

The following guidance material is intended to explain further the recommendations it refers to, contained in the European Action Plan for the Prevention of Runway Incursions, complementing the relevant ICAO provisions.

Time critical aerodrome information that may affect operations on or near the runway shall be provided to pilots in real-time using radiotelephony communication, through the Flight Information Services in accordance to ICAO Annex 11, Air Traffic Services, Ch. 2 and 4 (see recommendation 1.3.8).

In addition, collection, provision and dissemination of aeronautical information should be made in accordance with relevant ICAO provisions for Aeronautical Information Services (AIS). Knowledge of conditions at the aerodrome which may affect operations on or near the runway shall without delay be reported to States AIS for appropriate promulgation. A number of recommendations are made in support of this objective.

EAPPRI Recommendation 1.8.1 - concerns the provision of relevant, adequate, timely, and quality aeronautical data and aeronautical information

Quality assurance procedures shall be implemented by the ANSP/AISP. Adequate quality assurance procedures should also be implemented by any organisation that originates numerical data supporting aeronautical data elements. EUROCONTROL guidelines are developed supporting the implementation of Quality Management Systems in accordance with ISO 9001.

www.eurocontrol.int/articles/quality-phase-1-p-17

The aerodrome services responsible for the provision of raw aeronautical data shall take into account relevant aeronautical data quality requirements, in particular on accuracy and integrity, in accordance with applicable ICAO SARPS (Annex 11- Air Traffic Services, Ch. 2; Annex 14 – Aerodromes, Volumes I and II – Ch. 2; Annex 15 – Aeronautical Information Services, Ch. 3, Appendix 7; and Annex 4 – Aeronautical Charts, Appendix 6).

Reference documents:
ICAO Annexes 4, 11, 14, 15 and Doc. 8126.

Managing aerodrome information

For promulgation of aerodrome information, States AIS needs adequate time for the preparation, production and issuance of relevant material. This is relevant for promulgation of new information, permanent changes to published information and for temporary changes. Close coordination is therefore required between those services concerned in origination, surveying and provision of aerodrome data to ensure timely provision of information.

Of particular importance in the view of runway incursion prevention are changes that affect aerodrome charts published in the AIP (e.g. Aerodrome Chart, Aerodrome Ground Movement Chart) and information that qualifies to be notified by AIRAC.

The predetermined AIRAC effective dates shall be observed by the responsible aerodrome services in the planning of publication of aeronautical information and when submitting aeronautical information/data to AIS.

NOTAM and AIP Supplements

Notification of temporary changes is made through appropriate means of the Integrated Aeronautical Information Package (IAIP) considering the period of validity and nature of the information. AIS shall follow the operating procedures as described by ICAO Doc. 8126 (AIS Manual) and the EUROCONTROL Operating Procedures for AIS Dynamic Data (OPADD). The OPADD document provides guidance on NOTAM format and content, with the purpose to achieve harmonisation in the NOTAM output for the benefit of the users.

A NOTAM should not remain in force for more than three months. When the condition issued by a NOTAM exceeds the three month period, a new or replacement NOTAM may be issued, but only in those cases where the condition is expected to last for a further period of maximum one to two months. If it is expected that the condition will last for an additional three months or more, an AIP Supplement shall be issued.

Information on temporary changes of the operating conditions at the aerodrome shall be optimized to increase the situational awareness of the most critical changes. When needed, AIP Supplement with graphics and charts should be published. In general, an AIP Supplement shall be considered for temporary changes with duration three months or longer and for information of short duration which contains extensive text and/or graphics.

Reference documents:
ICAO Annexes 4, 14 and 15, ICAO Doc. 8126
EUROCONTROL Operating Procedures for AIS Dynamic Data - OPADD (Ed. 4.0)

Data quality monitoring

Compliance with the quality management system in place shall be monitored by States AIS. AIS should for instance monitor the departure/arrival time of the AIS products and the time required for postal delivery, in order to adhere to the AIRAC system. EUROCONTROL's tool "pTracker" supports such monitoring activities.

More info:
www.eurocontrol.int/services/ptracker-ais-publication-postal-delivery-time-tracking-tool

Data consistency & completeness

European AIS Database (EAD) enables aeronautical information providers to enter and maintain their data in the repository and enables data users to retrieve and download AIS data and AIP charts in a digital format. The quality of data is enhanced by using international standards and data checking procedures, including validation and verification. EAD performs regular data quality/completeness reviews and reports results to data providers.

More info:
www.eurocontrol.int/ead

Single European Sky (SES) regulation on aeronautical data quality (ADQ)

The Commission Implementing Regulation (EU) No 73/2010, amended by 1029/2014, is laying down the requirements on the quality of aeronautical data and information for the single European sky, in terms of accuracy, resolution, integrity and timeliness (ADQ). The ADQ IR is supplementing and strengthening the requirements of the ICAO Annex 15, Aeronautical Information Services to achieve aeronautical data and information of sufficient quality to support current and future flight operations.

The scope goes beyond the ANSPs/AISPs to include non-ANSP entities. In terms of scope, the aeronautical data/information process chain extends from original data sources (e.g. surveyors, procedure designers, aerodrome authorities, etc.), through AIS and publication to the end users of data and information, either by human users or aeronautical applications. Concerning Aerodrome Operators, it applies for those aerodromes for which IFR or Special-VFR procedures have been published in national AIPs; as such procedures demand higher data quality.

More info:
www.eurocontrol.int/adq

http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32010R0073

http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=uriserv%3AOJ.L_.2014.284.01.0009.01.ENG

This is linked to the SES implementation objective ITY-ADQ – Ensure quality of aeronautical data and aeronautical information, which is derived from the Commission Regulation (EU) 73/2010. The SES implementation objective applies to ANSPs, AIS Providers, operators of those aerodromes and heliports for which IFR or Special-VFR procedures have been published in national aeronautical information publications, public or private entities providing services for the origination and provision of survey data, procedure design services, electronic terrain data, electronic obstacle data and manufacturing industry.

More info:
www.atmmasterplan.eu/depl/essip_objectives

EAPPRI Recommendation 1.8.2 - concerns data integrators/data (DAT) providers / post-AIS data providers

Once aerodrome data has been acquired to the required quality standards, data should be protected from corruption during collation and publication by AIS and by all industry data preparation agencies during the processing of data.

Involved parties should take measures to ensure that the integrity of AISP data is preserved when ingesting and processing this data. Processes between DAT providers and AISP should be in place (e.g. letters of agreement concerning data quality) with the objective to ensure that aeronautical data is processed according to the relevant standards.

Reference documents:
EUROCAE ED76/RTCA DO 200 (series documents), Standards for processing Aeronautical data

EUROCAE ED 77/RTCA DO 201 (series documents), Standards for Aeronautical Information

Commission Regulation (EU) 2017/373 Annex VII Part-DAT (applicable January 2020).

ICAO Annex 15Aeronautical Information Services

EAPPRI Recommendation 1.8.3 - concerns the users' feedback process and post-flight information

AISPs should as part of the Quality Management System (QMS) establish procedures allowing for the users to provide feedback concerning the availability and quality of aeronautical information. A mechanism should also be in place to ensure that the users' queries are addressed accordingly.

Post-flight information

Additional information/data relating to the aerodrome of departure and any inadequacies observed shall be reported by Aircraft Operators (ref. Annex 6, Part 1 - Ch 4 and Part II, Section II - Ch 2) and collected to enable AIS processing of post-flight information without delay (ref. Annex 15 and Doc. 8126 – Ch. 8 and Annex 14, Volume 1 – Ch. 9).

Arrangements shall be made for aerodromes for collection of information concerning the state of operations of air navigation facilities and services noted by aircrew. These arrangements shall ensure that the information is made available to AIS, for distribution as the circumstances necessitate.

Pilots should adhere to the established procedures and reporting mechanism.

Reference documents:
ICAO Annex 6, 14 and 15
ICAO Doc 8126

Communication tools
EUROCONTROL has means in place to facilitate communication:

- AIS AGORA" is an aeronautical information online forum recognized globally.
  www.eurocontrol.int/aisagora

- "@is online" is a collection of links about the AIS and aeronautical information resources available on the internet. www.eurocontrol.int/articles/ais-online

EAPPRI Recommendation 1.8.4 - concerns user friendliness of the AIP Charts

Aerodrome charts are provided in a wide variety of formats. Some formats are user friendly and some may compromise pilots as they fly from one State to another, requiring extra effort to ensure correct understanding of the important information they contain. In particular, Hot Spots at aerodromes need to be clearly communicated.

Note: *ICAO definition of Hot Spot: A location on an aerodrome movement area with a history or potential risk of collision or runway incursion, where heightened attention by pilots/drivers is necessary (ICAO Annexes 4 and Annex 14 Volume 1).*

Designation and publication of Hot Spot(s) in States AIP

The respective aerodrome operator shall designate, whenever necessary, a location or several locations on the movement area of the aerodrome as Hot Spot(s). Hot spot(s) shall be published in the AIP on the relevant charts for those aerodromes with a history where there is a potential increased risk of collision or runway incursion and where heightened attention by pilots/drivers is necessary.

The criteria used to establish a hot spot on a chart and the symbols to be used are contained in ICAO Annex 4, with more guidance provided in Annex 14 Aerodromes, Volume 1 - Aerodrome Design and Operations, ICAO Doc. 9870 Manual on the Prevention of Runway Incursion and ICAO Doc. 8697 Aeronautical Charts Manual.

Published hot spot information shall be clear and effective and should consider the following charting guidance:

- Each hot spot is depicted by a clear bright red circle and joined to a red label box, providing the assigned designator of the hot spot if applicable (e.g. HS1, here meaning "Hot Spot 1").
- Large tabulated textual information elaborating the action required of pilots in and around the hot spot. This may be inserted on the main aerodrome diagram or on the verso of the chart.
- Additional graphical boxes depicting the hot spots in greater detail. These additional boxes should if possible be linked to the relevant hot spot on the main aerodrome diagram, by lines or arrows.
- Publish specific hot spot pages in cases where the aerodrome diagram otherwise would be too cluttered, to present the hot spots effectively.
- Usage of a colour-coded format assisting the depiction of runways, hot spot areas and normal taxiways.

Publication of Runway holding positions in States AIP

ICAO defines the required publication resolution for runway holding positions (Annex 15, App. 7 and Annex 4, App. 6), and includes in Annex 4 provisions and symbols for insertion of this information on relevant aeronautical charts. This data element is stated as critical in the ICAO Aeronautical Data Quality Requirements tables.

ICAO Annex 15 (Appendix 1) does not contain a requirement to publish the latitude /longitude of runway holding positions in the State AIP, Part AD, AD 2.
Nevertheless, timely and accurate information of established runway holding positions is vital for runway incursion prevention, and their publication in the AIP and on (electronic) charts. Therefore geographical coordinates of Runway holding positions should be published in States AIP.

Similar ambiguity in ICAO SARPS, where quality requirements have been defined but no publication required, is observed in relation to some essential aerodrome data elements such as geographical coordinates of taxiway centre line points, taxiway intersection marking line, and taxiway/runway shoulder width.

Reference documents:
ICAO Annexes 4, 14 and 15
ICAO Doc. 8697 & Doc.9870

EAPPRI Recommendation 1.8.5 - concerns Digital Aeronautical Information Management

The availability of digital aeronautical information depends upon the move towards a networked data centric environment based on common data exchange formats, which are enabling interoperable data exchange. The Aeronautical Information Exchange Model (AIXM), developed by EUROCONTROL and FAA, supports the ICAO and user requirements for aeronautical data including obstacles, terminal procedures and aerodrome mapping databases. The AIXM contains an exhaustive temporality model that enables the provision of digital dynamic updates of aeronautical information (digital NOTAM), which in turn enables enhanced pre-flight information briefing products and updates of digital charts (on the ground and in the air) providing the latest information about the aerodrome surfaces.

More info:
www.aixm.aero

Aerodrome Mapping Databases (AMDB) is one of the fundamental developments to runway incursion prevention. ICAO Annex 15 includes since 2013 provisions to States on aerodrome mapping data requirements for provision and aerodrome mapping data product specification, and AMDB dataset content and structure. This enables States AISPs, airlines and aerodromes to move towards a business driven collaborative information sharing environment.

In order to enable collaborative runway incursion prevention applications, it is recommended to create common on-line aerodrome mapping services based on the EUROCAE ED-99 series Aerodrome mapping standard. The implementation should follow a services oriented approach. This will enable on-line access of shared Hot Spot information and electronic display in e.g. on-board Electronic Flight Bags and technologies used by operational staff on the maneuvering area, enabling an enhanced and common situational awareness at the aerodrome.

More info:
www.eurocontrol.int/aim
www.eurocontrol.int/articles/AMDB

Reference documents:
EUROCAE ED-99/RTCA DO-272 (series documents)
"User requirements for airport mapping"

It specifies the user requirements for aerodrome mapping database content and quality. The document forms the basis for an RTCA/EUROCAE specification effort related to the creation of a common database interchange standard for aerodrome mapping.

EAPPRI Recommendation 1.8.6 - concerns formal arrangements between aerodrome operators and AISP for provision of quality assured aeronautical data and/or aeronautical information.

The aerodrome operator determines, documents and maintains, as appropriate, data relevant to the aerodrome and available services. This data should be provided to the users and relevant ATS and AIS providers.

Formal arrangements shall be established between the aerodrome operators and the AISP in order to support and enable exchange of the relevant aeronautical data and/or aeronautical information with the required quality and integrity.

The Commission Regulation (EU) No. 73/2010 on aeronautical data quality (ADQ) addresses interoperability between the data supply chain actors from original data sources through AIS to the next intended user.

The AMC and GM to the Commission Regulation (EU) No. 139/2014 on aerodromes address data quality requirements, the content of such formal arrangements and the necessary coordination between aerodrome operators and providers of aeronautical information services.

EUROCONTROL has developed ADQ guidance material to facilitate the establishment of formal arrangements and SLAs between aeronautical data originators/providers and AISP, with the purpose to set agreed required quality levels of the data, the timeframe of delivery and their format:

- ADQ Formal Arrangements (FA) Guidelines, including templates, document structure and implementation checklist.

More info:
www.eurocontrol.int/adq
www.eurocontrol.int/articles/adq-library

Reference Documents:
ICAO Annex 4 - Aeronautical Charts

ICAO Annex 6 - Operation of Aircraft

ICAO Annex 11 - Air Traffic Services

ICAO Annex 14 - Aerodromes, Volume 1 - Aerodrome Design and Operations

ICAO Annex 15 - Aeronautical Information Services

ICAO Doc. 8126 - Aeronautical Information Services Manual

ICAO Doc. 8697 - Aeronautical Chart Manual

ICAO Doc. 9870 - Manual for Preventing Runway Incursions

Commission Regulation (EU) No. 73/2010

Commission Regulation (EU) No. 139/2014

EUROCONTROL Operating Procedures for AIS Dynamic Data – OPADD (Ed. 4.0 April 2015)

APPENDIX I
GUIDANCE FOR JOINT-USE CIVIL/MILITARY

Aerodromes

Background

Military aviation and runway incursions

EAPPRI and military

Aerodrome Operator

One aerodrome, two authorities

Mixed Type of Flight

Mixed Type of Aircraft

Radio Equipment and Procedures

Aerodrome Markings

Use of the Runway Lights

Ad Hoc allocation of military staff at civil aerodrome

Conclusion

APPENDIX I GUIDANCE FOR JOINT USE AERODROMES – CIVIL-MILITARY

BACKGROUND

One approach to increasing airport capacity is to operate from joint-use aerodromes. A number of communities see the opening of military airbases for civilian use as an opportunity for local economies. Joint-use aerodromes may be used for the training/flight checking of airline pilots or as bases for technical and test flights.

There are already numerous joint-use aerodromes, hosting different types of military aviation within ECAC. A number of air forces share aerodrome facilities with civil entities accommodating traffic which is both military and civil, domestic and international.

To support overseas operations, the military, very often as a part of multinational operations, use civil aerodrome facilities either as short-term refuelling stop aerodromes or as temporary bases.

The regulatory position varies from State to State. There is no agreed pan-European definition of a joint-use aerodrome; actual use differs among the States.

However, the European Union Regulation (EC) No 216/2008 in the field of aerodromes, air traffic management and air navigation service refers to the military (in particular, equipment, and organisations that are controlled by the military.[2]). Member States shall, as far as practicable, ensure that any military facilities open to public use, (aerodrome or part therefore) or services provided by military personnel to the public (ATM/ANS), offer a level of safety that is at least as effective as that required by the essential requirements of the European Union.

In addition, the EUROCONTROL Guidelines Supporting the Civil Use of Military Aerodromes (CUMA) highlight the key institutional, legal, financial, technical and operational issues. CUMA proposes a set of recommendations to support the national decision making process. For the purposes of this document, a joint-use aerodrome is either a civil aerodrome used regularly by military traffic or a military aerodrome used regularly by civil traffic. An aerodrome (ICAO term) and an airfield (military term) should be considered as synonyms.

MILITARY AVIATION AND RUNWAY INCURSIONS

The military aviation community is not immune from runway incursions. EUROCONTROL collects runway incursion reports on a yearly basis. The operational data confirms the involvement of military aircraft in **runway incursions** within the ECAC area. The reports verify the military aircraft's involvement regardless of types of operations and types of flight rules.

Military personnel can therefore contribute to the prevention of runway incursions. Like all staff operating on the manoeuvring area, military personnel, need to be aware of the potential hazards.

ICAO Annex 13 defines responsibility for the investigation of runway incursions involving civilian assets/persons. The reporting of runway incursions in civil aviation is mandated for EU members [3].

The prevention / investigation / reporting of runway incursions involving only military is a state responsibility. In accordance with ESARR 2 [4], reporting is mandated for the military in all occurrences where:

- Civil Air Traffic Services is providing service to military aircraft, and
- Military Air Traffic Services and/or Air Defence are providing service to civil aircraft.

EAPPRI AND MILITARY

In respect of the application of EAPPRI recommendations, the military should be involved as:

- **Regulator:** military aviation authority (MAA) or equivalent national regulatory body;
- **Aerodrome operator:** military aerodrome and military unit co-located with a civilian aerodrome;
- **ANSP:** where the military provides aerodrome air traffic services to civil airspace users;

2. *See Article 1 of Regulation (EC) No 216/2008*
3. *Commission Regulation (EU) No 376/2014 on the reporting, analysis and follow-up of occurrences in civil aviation*
4. *EUROCONTROL Safety ATM Regulatory Requirements*

- **Aircraft operator:** military aircraft operator based/operating at joint use aerodromes, i.e. where the aerodrome operator is civilian and the Air Traffic Services provider is civilian.

Note that for some States there is one regulator responsible for all ATM matters, civil and military, and in others there may be two regulators with discrete civil or military responsibilities.

With the support of civil and military stakeholders, EUROCONTROL has identified some specific factors causing and contributing to runway incursions at joint-use aerodromes, by collecting experiences on a voluntary basis. The current EAPPRI recommendations have been reviewed in the light of the needs of joint-use aerodromes and recommendations for the Prevention of Runway Incursions at Joint-Use Aerodromes developed.

AERODROME OPERATOR

There are three main areas at aerodromes where civil and military operations interact: the apron, the manoeuvring area and approach/terminal airspace.

There are joint-use aerodromes where one aerodrome operator (civil or military) is wholly responsible for manoeuvring area operations. There are also joint-use aerodromes where more than one aerodrome operator is responsible for a specific segment of the aerodrome movement area.

To clarify roles and responsibilities, one of the aerodrome operators should take the lead in the coordination of the application of EAPPRI recommendations.

When implementing CUMA, the civil aerodrome operator should verify and assess differences between the existing services and infrastructure and the related ICAO provisions; such differences should be notified by means of Aeronautical Information[5].

The civil and/or military aerodrome regulator may perform the task of re-certifying an aerodrome, and may clarify roles and responsibilities.

MIXED TYPE OF FLIGHT

Joint-use aerodromes facilitate both types of flights, civil and military. The majority of applicable ICAO provisions are identical, although differences may be found regarding procedures for formation flying or other military functions. The application of different types of procedure could create confusion during aerodrome operations.

For instance, as per Recommendation 1.10.9, conditional clearances should not be used for civilian traffic during military formation flight operations. Further, during surface movement, a formation of aircraft is considered as a single aircraft in terms of right-of-way. When an individual aircraft and a formation are on a converging course, a formation of aircraft should be treated as one entity.

At present, the application of mixed aerodrome operations requires a safety assessment by each State at each joint-use aerodrome.

Timely and effective coordination between the various airport entities responsible for ground operations is important. One of the practices at joint-use aerodromes is regular coordination between civil and military entities facilitating mixed types of operations. The means of coordination can range from a joint civil-military coordination body to a liaison officer assisting with daily coordination. In certain cases, the representative of a flying unit is present in the tower during military operations.

MIXED TYPE OF AIRCRAFT

Civil pilots may not be able positively to identify military aircraft types. ATC instructions involving specific military aircraft types, e.g. "Follow F 1", should be avoided.

5. *EUROCONTROL Guidelines Supporting the Civil Use of Military Aerodromes*

RADIO EQUIPMENT AND PROCEDURES

Even though the majority of military aircraft are VHF/UHF radio equipped, military aircraft very often operate using UHF. Civilian aircraft use VHF only.

Simultaneous aerodrome operations using different frequencies are a known practice at joint-use aerodromes, and may lead to communication breakdowns and reduced situation awareness.

Special procedures are applied, e.g. TWR/GND transmission on both VHF and UHF frequencies, and cross-coupled VHF and UHF frequencies.

Military pilots and controllers may use non-standard ICAO phraseology. Very often, a domestic language is in use at national joint-use aerodromes. There are also instances in which approved R/T phraseology means different things to civil and military pilots.

Both practices could cause a breakdown in communication and reduce situation awareness.

AERODROME MARKINGS

A number of markings around military aerodromes may be different from the ICAO standards. Some of them are outside the movement area for civil aircraft; however, those which are visible to civil pilots/drivers could lead to pilot or vehicle driver navigation error.

USE OF THE RUNWAY LIGHTS

The technical characteristics and operational procedures for air-ground lighting at joint-use aerodromes sometimes deviate from ICAO Annex 14 - Aerodromes, Volume 1 - Aerodrome Design and Operations.

The application of different light-operating procedures may reduce situation awareness on or around the runway.

AD HOC ALLOCATION OF MILITARY STAFF AT CIVIL AERODROME

Military pilots and ground personnel, coming from all around the world, may not be familiar with ICAO flight rules, phraseology, aerodrome signs, lights and markings. They will also be unfamiliar with local aerodrome procedures.

Moreover, because of the regular rotation of military personnel, local familiarisation training is required.

CONCLUSION

- Military aviation is not immune from runway incursions. Military personnel can therefore contribute to the prevention of runway incursions. One way of achieving appropriate awareness is through participation in an aerodrome local Runway Safety Team.
- Even though the majority of ICAO recommendations are directly applicable, there are some particular points with regard to joint-use aerodromes covered by EAPPRI only.
- The civil and military authorities responsible for flight safety at the aerodrome should identify the potential risk regarding the unauthorised use of the runway and other portions of the manoeuvring area and implement measures to prevent events resulting in potential or actual runway incursions[6].
- States may consider implementing recommendations and guidance material identified in EAPRRI for their application at joint-use aerodromes.

REFERENCES:

1) ICAO Annex 13 Aircraft Accident and Incident Investigation

2) ICAO Doc. 4444, PANS-ATM, Part IV

3) EU Regulation (EC) No 216/2008

4) Commission Regulation (EU) No 376/2014 on the reporting, analysis and follow-up of occurrences in civil aviation

5) EUROCONTROL Guidelines Supporting the Civil Use of Military Aerodromes; Edition 1.0

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6) EUROCONTROL Safety ATM Regulatory Requirements (ESARR2)

6. EUROCONTROL Guidelines Supporting the Civil Use of Military Aerodromes

APPENDIX J

USE OF AERONAUTICAL GROUND LIGHTING THAT PROTECTS THE RUNWAY

Introduction

Light Colours and Their Meanings at Runway Entrances

Stop Bar Implementation and Use Policy

Stop Bars Operational Use

Autonomous Runway Incursion Warning Systems (ARIWS)

LEDs

'Follow the Greens'

Conclusion

APPENDIX J USE OF AERONAUTICAL GROUND LIGHTING THAT PROTECTS THE RUNWAY

INTRODUCTION

Runway incursions have been a hazard in the aviation industry for some time. Recent technological advances have allowed air navigation service providers (ANSPs) and airport operators to invest in the deployment of warning systems aimed at preventing incursions and/or mitigating the effects of an incursion. These systems range from traditional runway guard bars ("stop bars") operated by air traffic services (ATS) personnel, to more advanced autonomous systems that are deployed or under evaluation at various airports.

The use and colours of lights are widely accepted across the aviation world. Clear requirements exist for the exterior lighting of airframes to assist pilots in situational awareness and collision avoidance. There are protocols for the lighting of vehicles on aerodromes, obstacle and obstruction lighting and for the use of warning lights on the flight deck.

Although ICAO Annex 14, Volume 1 provides for the use of certain types of lighting to protect the runway, no specific priority or meaning is attached to these lights. A proposed definition and priority is one purpose of this appendix.

Light Colours and Their Meanings at Runway Entrances (see table below)

1. **RED** lights ahead of an aircraft or vehicle mean: it is unsafe to proceed beyond the RED lights. This is the case regardless of whether the lights are fixed, alternating or flashing and is independent of an ATC clearance. **RED** means **STOP!**

2. **YELLOW** lights are used to convey a similar but less distinct message. They indicate that a potential hazard exists beyond the lights, but that in conjunction with an appropriate ATC clearance it will be safe to proceed.

3. **GREEN** lights are often used to indicate the route to be followed by an aircraft or vehicle, particularly at night or in periods of reduced visibility. In all cases green lights are a routing aid and **must only be followed in conjunction with an ATC clearance**.

Light Colour (in order of priority)	ATC Operational use	Meaning for the pilot or manoeuvring area driver	Example
RED	May be manually or automatically switched and/or deselected in conjunction with an ATC clearance	**STOP** Pilots and drivers should contact ATC and await or confirm clearance; NEVER CROSS RED LIGHTS	Runway Stop Bars
YELLOW	None	**CAUTION** Runway ahead, do you have an ATC clearance to proceed?	Runway Guard Lights
GREEN	May be manually or automatically switched and/or deselected in conjunction with an ATC clearance	**PROCEED** Only in conjunction with an ATC clearance	Taxiway Centreline Guidance

Air Traffic Control, together with Aerodrome Operators, should operate the lights on or near a runway so that a pilot or manoeuvring area vehicle driver is never instructed to enter, cross, or use a runway counter to the meaning of the lights described here. Especially, Flight crews and manoeuvring area vehicle drivers should not be instructed to cross illuminated stop bars.

Pilots and manoeuvring area vehicle drivers shall never cross red lights nor enter, cross, or use a runway without a valid ATC clearance to do so.

Recommendation 1.2.14 states "Regularly assess the operational use of aeronautical ground lighting e.g. stop bars, to ensure a robust policy to protect the runway from the incorrect presence of traffic".

For this purpose, the following should be taken into consideration.

Consider the benefits of using technology as a safety net to provide immediate and simultaneous runway and traffic proximity alerts for Pilots, Air Traffic Controllers and Manoeuvring Area Vehicles and to help to protect the runway. Systems such as Stop bars, No-entry bars, Runway Guard Lights (RGL) and ARIWS/RWSL, that protect the runway should be ICAO and, as appropriate, EU compliant.

Check aerodrome lighting from different heights to replicate driver and cockpit views/perspectives.

STOP BARS – IMPLEMENTATION POLICY

Stop bars and runway guard lights that protect the runway should be EU and ICAO compliant. Consider using stop bars and runway guard lights at all runway holding positions under all weather conditions (24 hours a day) to help prevent runway incursions.

Consider installing extra lights, uniformly, to enhance conspicuity of an existing stop bar.

Consider adding a pair of elevated lights to each end of the stop bar:

- To enhance their conspicuity to pilots and manoeuvring area drivers when needed.
- Where the in-pavement stop bar lights might be obscured from a pilot's view, for example, by snow or rain.
- Where a pilot may be required to stop the aircraft in a position so close to the lights that they are blocked from view by the structure of the aircraft.

These lights should be visible to approaching aircraft up to the stop bar position.

When planning to implement stop bars, it is important to acknowledge the potential cost. Therefore, it should be taken into consideration that:

- Stop bars located across entrance taxiways are selectively switchable.
- Stop bars located across taxiways intended to be used only as exit taxiways are switchable selectively or in groups.
- Stop bars should be interlocked with the first 90 meters taxiway centre lights beyond the stop bar so that when centre line lights beyond the stop bar are illuminated the stop bar is extinguished and vice versa.
- The light´s electrical system should be designed so that all lights of a stop bar will not fail at the same time.

In the event of stop bars failing in the illuminated state, appropriate contingency procedures are required. For example, those specified in GM1 SERA.3210 (d) (3) Right-of-way:

"When considering contingency arrangements for situations where the stop bars cannot be turned off because of a technical problem, the air traffic service provider should take into account that such contingency arrangements should significantly differ from normal operations and should not undermine the principle that a lit stop bar must not be crossed."

The service provider may consider, inter alia, the following:

(a) physically disconnecting the respective lit stop bar from its power supply;

(b) physically obscuring the lights of the lit stop bar; or

(c) providing for a marshaller or a follow-me vehicle to lead the aircraft to cross the lit stop bar."

In addition, stop bar contingency plans may include closing the taxiway where the failure happened and using an alternative, suitable runway holding position equipped with a functioning stop bar. Exceptionally, ATC may instruct pilot to cross/enter the runway with a specific clearance given by ATC to cross an illuminated stop bar due to a malfunction of the system and a specific read back of crossing an illuminated stop bar due to a malfunction of the system.

The objective is to maintain the integrity of the stop bars, which are intended to protect the runway at any airport the pilot may fly to.

Access to active and non-active runways requires a specific ATC clearance to enter or cross the runway. An extinguished stop bar, or any other red light, on its own does NOT constitute a clearance to enter or cross a runway.

STOP BARS – OPERATIONAL USE

When planning to implement stop bars, it is important to acknowledge the potential ATC workload increase. Therefore, it should be taken into consideration:

- To manage the length of time the stop bar is extinguished to ensure:
  - That aircraft and vehicles have crossed them prior to their re-illumination.
  - When conditional clearances are in use to avoid the incorrect presence of a second aircraft or other traffic on the runway.
- To provide an interface at the TWR so that:
  - Stop bars can be individually selectable by the runway controller.
  - The number of inputs (clicks) to switch on and to switch off the stop bar should be reduced to a minimum.
  - The interface´s screen should be available from the controller position in an ergonomic way so the controller does not have to turn his/her head and body significantly.

AUTONOMOUS RUNWAY INCURSION WARNING SYSTEMS

Consider the Implementation of an Autonomous Runway Incursion Warning Systems (ARIWS), for example Runway Status Lights (RWSL), which have been developed to deliver automatic warnings and runway status indications to pilots and manoeuvring area vehicle drivers.

The operation of an ARIWS is based upon a surveillance system which monitors the actual situation on a runway and automatically returns this information to warning lights at the runway (take-off) thresholds and entrances.

- When an aircraft is departing from a runway (rolling) or arriving at a runway (short final), red warning lights at the entrances will illuminate, indicating that it is unsafe to enter or cross the runway.
- When an aircraft is aligned on the runway for take-off and another aircraft or vehicle enters or crosses the runway, red warning lights will illuminate indicating that it is unsafe to start the take-off roll.

Thus, in accordance with the principles presented in this appendix, when ARIWS lights are triggered, pilots and drivers are presented with a globally consistent signal which means "STOP IMMEDIATELY".

LEDS

Consider the use of LED lighting as they enhance the pilot and driver experience with a more precise colour and a higher apparent luminance.

'FOLLOW THE GREENS'

Consider the use of lighting systems that provide taxiway routing guidance e.g. so-called 'Follow The Greens' technology which are seen as beneficial to navigating on the ground by pilots to prevent misrouting.

CONCLUSIONS

Defining the meaning and priority of lights as described in this Appendix is the first step in identifying categories and types of system.

To achieve the main aim of this work and despite advances in recent years, the delivery of a consistent level of service regarding the use of lights that protect the runway around the world is needed. Next steps include the:

- Promotion of international standards for the use of lights that protect the runway and associated procedures.
- Development of global requirements necessary to ensure consistent use of lights that protect the runway.
- Enhancement of procedures and relevant training for all operational staff working on the manoeuvring area.
- Coherent integration of ground, ATC and aircraft systems in the future.


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APPENDIX K

AERODROME DESIGN GUIDANCE FOR THE PREVENTION OF RUNWAY INCURSIONS

Introduction

Aerodrome Design Principles

Aerodrome Infrastructure Naming

Other

APPENDIX K AERODROME DESIGN GUIDANCE FOR THE PREVENTION OF RUNWAY INCURSIONS

INTRODUCTION

Recommendation 1.2.12 states "New aerodrome infrastructure and changes to existing infrastructure should be designed to reduce the likelihood of runway incursions".

This recommendation is consistent with Commission Regulation (EU) No139/2014 and its guidance materials on aerodrome design (GM1 ADR-DSN.D.240).

Indeed, airfield design has a significant impact on the likelihood of runway incursions, and on the severity of their consequences. Complex geometries are a source of confusion and incidents. Suitable aerodrome design can dramatically reduce the risk of a runway incursion whilst enabling operations efficiency and enhancing aerodrome capacity.

The design principles suggested in this guidance material can be applied to new aerodrome infrastructure and changes to existing infrastructure. In either case, it is essential to include all stakeholders in the decision making and change management process, especially airlines/ pilots and ATC; aerodrome local Runway Safety Teams can provide a conduit for this consultation. The efforts of airfield geometry improvement shall be prioritised following a risk-based approach. The areas treated in priority should be those of higher risk, as identified by the airport and ANSP Safety Risk Management (SRM), using a quantitative/ probabilistic method (aeronautical study), accident and incident records (statistics), or the local experience. Lessons learned and good practices from other airports are also a good source for identifying the infrastructure requiring corrective actions.

The key objectives when designing airfield infrastructure should be to simplify the geometry and minimise the constraints on the operations, whatever the type of traffic and the location of the aerodrome. The airfield layout and the visual aids should be conspicuous and easy to understand, for both the air crews and the airfield drivers.
The infrastructure should comply with the standards for the largest, most frequent aircraft type (commonly called "design aircraft") as specified in the terms of the Aerodrome Operating Certificate. Occasionally, it may be possible to accommodate a more demanding aircraft based on a safety study, and operational procedures when appropriate. More generally, infrastructure and procedures together should be suitable for all the aircraft intended to use each aerodrome.

AERODROME DESIGN PRINCIPLES

Runway entrances

Air crews need an unobstructed view of the runway, in both directions to the thresholds, to confirm that the runway and its approach are clear of conflicting traffic before proceeding to enter onto this runway. To provide this clear view, runway entrances should be perpendicular to the runway as far as practicable. When this is not technically achievable, the pilots must have a direct view from the cockpit to the runway and its approach when crossing the holding positions and entering onto the runway. The use of "RUNWAY AHEAD" (white on red) surface markings - whilst not ICAO compliant - to supplement signs and lighting, enhances situational awareness of pilots and drivers and has proved to be beneficial runway incursion prevention measure at many (but not all) aerodromes.

The lack of visibility due to an alignment of a runway by a Rapid Exit Taxiway (RET) was a contributive factor in a runway incursion which led to a collision in May 2000 at CDG.[7]

Multiple taxiway entrances at one location, also known as Y-shaped connectors, increase the risk of confusion and often reduce the visibility from the taxiway to the runway. More generally, limiting the options available to pilots on each entrance (or exit) helps to avoid confusions.

It is recommended to implement taxiway widths adapted to the aviation traffic of the aerodrome, and in compliance with the standards for the design aircraft (cf. CS ADR-DSN Chapter D). Wide (nonstandard) taxiway entrances reduce the effectiveness of signs and markings as aids to prevent ground routing error and the infringement of the runway protections. As per Recommendation 1.2.16a, closely spaced multiple parallel runway holding positons on the same taxiway should be avoided. The creation of islands with the use of artificial turf, green painting, or zebra markings is a good practice for clearly segregating the routes and optimising the perception of the visual aids preventing runway incursions.

These visual aids are primarily the runway-holding position marking, the mandatory instruction markings and signs, and the enhanced taxiway centreline markings (CS ADR-DSN Chapters L and N).

7. http://www.skybrary.aero/index.php/SH33_/_MD83,_Paris_CDG_France,_2000

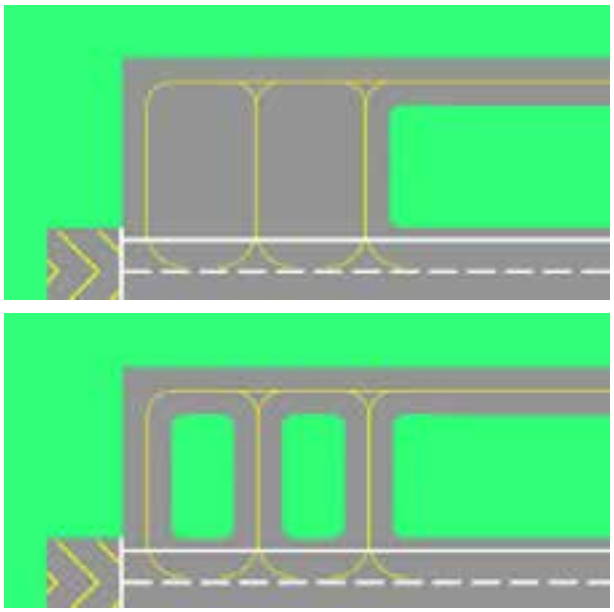

Fig 4: ntroduction of islands for separating access taxiways

On a multi-runway system, including convergent or crossing runways, a particular attention should be given to taxiway design in order to avoid confusions between the runways. As far as practicable, two runways intersecting at one of their extremity should be clearly separated (EASA CS ADR-DSN Chapter D).

Rapid Exit Taxiways

Rapid Exit Taxiways (RET) are designed to be runway exits only. The acute angle between the Rapid Exit Taxiway and the runway axis does not provide a line of sight from the cockpit backward to the active runway extremity. "NO ENTRY" mandatory instruction markings and signs should be used to prevent incursions on RET.

RET should be long enough for an aircraft to decelerate down to the taxi speed prior to join any other taxiway. A RET should meet with a parallel taxiway, and never end directly onto another active runway (that is used for take-off/landing).

Note: *EASA GM1 ADR – DSN.M.745 states that "Active runway is to consider any runway or runways currently being used for take-off or landing. When multiple runways are used, they are all considered active runways."*

Taxiway crossing active runways

Airfield design should avoid configurations including crossing a runway as a basic route for gaining access to another part of the aerodrome. This is not easily achievable for instance when an airport is developed on both sides of a runway, or on multi-runway systems with Closely Space Parallel Runways (CSPR).

It is possible to significantly reduce the number of aircraft crossing with a taxiway bypassing the entire runway. Such an infrastructure is called a perimeter taxiway (PT) or an End Around Taxiways (EAT).

End Around Taxiway can contribute to reduce the Runway Occupancy Time (ROT), taxi time and congestion on the manoeuvring area, as the time spent waiting for crossing a runway during peak hours can be considerable.

Sufficient space is required between the by-passed runway and the EAT centreline where it crosses under the approach or takeoff path, in order to enable aircraft to taxi while aircraft are operating from and to the runway. The specifications for Runway End Safety Areas (RESA), and possible interference with the ILS and other radio navigation aids should also be taken into account. The EAT should route traffic behind the localiser (LLZ) antenna, and not between the localiser antenna and the runway in order to allow simultaneous taxi on the EAT and precision approaches or LVTO.

Note: *Depending on the topography of the runway and EAT, an aircraft taking-off and facing the perimeter taxiway can believe that another aircraft using this taxiway is performing a runway incursion (or the opposite). Research efforts show that in this case, a screen between the runway end and the EAT prevent confusions.*

Fig 5: End Around Taxiway by-passing Threshold 04R at Detroit-Wayne Intl. Airport (DTW)

When runway/taxiway crossings cannot be avoided, avoid using mid- locations where departing aircraft have too much energy to stop, but not enough speed to take-off and clear an intruding aircraft or vehicle.

Taxiway centerline design should allow the aircraft to be perpendicular to the runway, thereby providing a clear line of sight to the active runway extremity.

Long, straight taxiways accessing to or crossing runway should be avoided, or replaced by 'zig-zags'.

For example, move from the 'straight' configuration on the left to the 'zig-zag' configuration on the right.

Fig 6: End Around Taxiway example screen

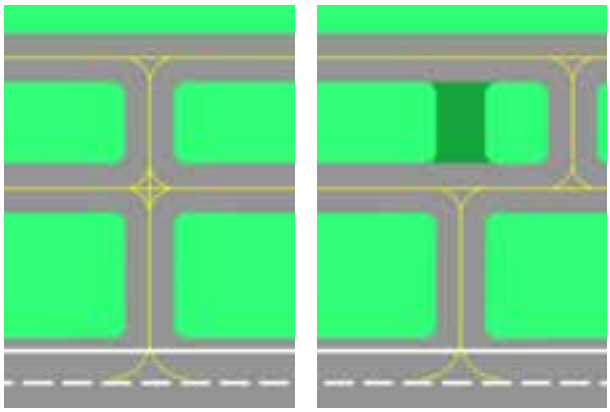

Fig 7: Introduction of a zig-zag for preventing runway incursion

Miscellaneous

- Runways should not be designed to be used as occasional taxiways and vice versa.

In the catastrophic collision of a Boeing 747-400 with a construction site at Taipei Taoyuan in October 2000, the aircraft mistook a full parallel taxiway under poor conditions of visibility, to be the active runway. This taxiway was widened in order to serve as an occasional runway.

- When practicable, permanently disused taxiways and roadways should be removed to prevent mis-routings and incursions. If left in place, the taxiway must be closed with ICAO compliant markings, signs and lighting. It must be shown and identified as decommissioned for navigation purposes on the aerodrome map/chart.

- The Air Traffic Control Tower should be located to allow the controllers to maintain a continuous watch on all flight operations on and in the vicinity of an aerodrome as well as vehicles and personnel on the manoeuvring area.

- Parallel taxiways (to the runway) minimise the time aircraft stay on the runway.

- Service roads should not intersect runways thereby minimizing the risk of a vehicle to infringe the runway protections without prior authorization. When a direct access is provided for RFF vehicles, conspicuous roadway markings and signage should clearly restrict its use by other vehicles and ATC should be contacted before entry.

AERODROME INFRASTRUCTURE NAMING

Convention

Taxiways should be designated in a simple and logical manner that is instinctive to pilots and manoeuvring area vehicle drivers. Taxiway and infrastructure designations should be the shortest possible. The complexity of the airfield layout at large airports should be addressed through collaborative, comprehensive Safety Risk Management (SRM) processes. The naming of taxiways should follow ICAO recommendations.

Different taxiways on the same aerodrome should not have the same or similar designations especially on different sides of the same runway. No taxiway should be left without a designation.

Taxiway names should be the shortest possible, and use single-letter and single-digit designations as far as practicable. However, it is not always possible to name all taxiways in such manner at large aerodromes. There, main taxiways should be designated by single letters. At large aerodromes, connectors could be named based on the main routes they connect (e.g. AB1, AB2, AB3 connecting taxiways A and B).

Another logic should be used for the taxiways that connect to the runway in order to reduce potential confusion. For instance, the names can be derived from the letter of the full parallel taxiway, when existing (e.g. P1, P2, P3 between taxiway P and the runway. A taxiway crossing a runway should not have the same name on each side of the runway, in order to clarify holding short instructions and prevent misunderstandings leading to runway incursions. In addition to these best practices, rules can be adopted locally for highlighting the difference between straight taxiways and Rapid Exit Taxiways on a same runway side, especially when their geometry does not reflect explicitly their status (e.g. angled non-RET access taxiway). For instance, a different letter can be used (e.g. P1, P2, P3 for the straight taxiways and Q1, Q2, Q3 for the RET).

OTHER

Lines of sight from the air traffic control tower

The Air Traffic Control Tower should be located such that it has good visibility of surface movements of aircraft and vehicles, without any visual restrictions.

However, when there are areas with no direct visibility from the ATC Tower, these may be published in an AIP Aerodrome chart. When these areas include runway holding points, cameras to provide controllers with a direct vision of the holding point should be implemented; other aerodrome surveillance systems such as A-SMGCS can also present additional information to controllers.


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APPENDIX L

MAINTENANCE, INSPECTIONS, WORKS IN PROGRESS/ TEMPORARY MODIFICATIONS OF THE AERODROME

Maintenance

Inspections

Works in Progress

Temporary modifications of the aerodrome

Aerodrome geometry

Visual aids (taxiways)

Prevention of runway incursions from roadway accesses

Briefing and supervision of Contractors/Works Staff

Aerodrome Operations – Protected Areas

APPENDIX L AERODROME OPERATOR – MAINTENANCE, INSPECTIONS, WORKS IN PROGRESS/TEMPORARY MODIFICATIONS OF THE AERODROME

MAINTENANCE

Recommendation 1.2.1a: Assess the implementation of ICAO Annex 14, Volume 1 and EU provisions and implement maintenance programmes relating to Runway operations e.g. markings, lighting and signage. Ensure that signs and markings are clearly visible, adequate and unambiguous in all relevant conditions.

Reviews should take place in different weather and light conditions to assess all runway entrances and visual aids to check that they are correctly located and clearly visible to pilots and drivers. Lights, signs and markings are checked for conspicuity at a height similar to the height of the smallest and largest aircraft and vehicles using the manoeuvring area; all markings and signs should be adequate for and understandable by all parties, with no possible ambiguity of their meaning.

The use of cameras on a vehicle that is driven all around the movement area has proven to be useful. The same process can be repeated in different weather conditions and with the cameras set at different heights.

INSPECTIONS

Recommendation 1.2.11: Aerodrome Operators, in conjunction with ANSPs, should review procedures for inspections

In order to prevent runway incursions, the aerodrome operator should have procedures in place for conducting runway inspections, including direction of runway inspection, communication procedures, actions in case of communication failure or vehicle breakdown, stop bars crossing, runway crossings, etc.

Commission Regulation (EU) No 139/2014 AMC2 ADR. OPS.B.015 (c) says:

A monitoring and inspection programme of the movement area should be established which is commensurate with the traffic expected at the aerodrome and the size and complexity of the aerodrome, in order to identify any default or potential hazards to the safety of aircraft or aerodrome operations.

Several types of inspections are normally performed:

a) Daily inspections, which provide an overview of the general condition of all movement area and facilities, covering items such as the presence of FOD, the status of visual aids, wildlife and current surface conditions, etc.

b) Regular inspections, which are part of the preventive maintenance of the aerodrome, are more detailed checks of the condition on the movement area and its associated facilities.

c) Extra inspections should be carried following the completion of works, a reported incident, a Pilot/ATC report and during or after excessive weather events (excessive heat, freeze and thaw periods, following a significant storm, etc; Inspectors should use checklists covering the various inspection areas. A sketch of the aerodrome may accompany the checklist so that the location of problems can be marked for easy identification.

When it is anticipated that inspections – or other activities - on the runway will be prolonged, the adoption of an 'Ops Normal' type call (e.g. "Call Sign still on runway 23") at a specific interval e.g. every 5 minutes from the driver to ATC to remind them of their presence on the runway may be considered.

See also Appendix E

WORKS IN PROGRESS

Recommendation 1.2.2: Assess all arrangements associated with aerodrome construction works/works in progress (WiP):

a. Ensure that up to date information about temporary work areas and consequential operational impact is adequately disseminated.

b. Ensure that sufficient coordination between ANSPs and Aerodrome Operator is in place prior to notification to the Regulator.

c. Ensure that temporary signs and markings are clearly visible, adequate and unambiguous in all appropriate conditions

When planning and carrying out works in progress on the manoeuvring area the aerodrome operator should:

- Ensure in the design stage that the changed layout does not increase the likelihood of runway incursions.
- Ensure that the layout changes are published in the AIP, NOTAMs or ATIS and local airfield notices in a timely fashion as appropriate.
- Ensure that the airfield signs, lights and markings are altered to reflect the changed layout.
- Ensure that air traffic control is aware of the changes.
- Ensure that the ground lighting and any associated control software are altered to reflect the new layout e.g. availability of green taxiway centre line lights linked to an unserviceable stop bar.
- Information to be promulgated should be discussed and coordinated with directly affected stakeholders, and subjected to checks to ensure that their meaning is clear to potential users.

When works in progress affect runway declared distances it is essential that these are promulgated using all appropriate methods as via ATIS-V/D, ATC, NOTAM including the figures of those temporary declared distances that have changed, temporary Information signage, or similar. This is to emphasize that this critical aerodrome information is properly received in the cockpit without having to consult a working phase in one of the multiple pages of the AIP Supplement in force.

The transition into and out of any work on the aerodrome can be particular challenging and needs to be carefully managed (by ATC and the aerodrome operator) to avoid misunderstandings about the status and availability of aerodrome surfaces and equipment.

TEMPORARY MODIFICATIONS OF THE AERODROME

Recommendation 1.2.12: New aerodrome infrastructure and changes to existing infrastructure should be designed to reduce the likelihood of runway incursions

In order to prevent runway incursions, the aerodrome operator should have procedures in place for conducting runway inspections, including direction of runway inspection, communication procedures, actions in case of communication failure or vehicle breakdown, stop bars crossing, runway crossings, etc.

Aerodrome layout

When preparing construction projects on the airside, airport operators should ensure from the early design that the modifications to the airfield layout does not increase the likelihood of runway incursions. This should be achieved through the Safety Risk Management (SRM) process of the project, as part of the airport Safety Management System. The Safety Risk Assessment (SRA) should evaluate the impacts on aviation safety of the modified ground routings, and of the infrastructure geometry itself.

The impacts on the operations can often be lowered with a proper phasing of the construction works. However, cutting the project in different phases increases operational complexity. It is more difficult to disseminate the information on time and in a simple way. It increases the likelihood of an error in the publication of the aeronautical information, and in the preparation of the flight. The phasing should carefully balance aviation safety, capacity and the needs of the construction project.

Visual aids (taxiways

Construction or Works in Progress may not necessarily allow retention of all the markings and signage on active portions of the airfield. When this is not possible, alternate visual aids should be provided. For instance, on a taxiway operated by night or low visibility, if the taxiway centreline lights cannot be maintained, a temporary taxiway edge lights should be provided. Mandatory escort by a "Follow-me" vehicle can be a temporary alternative to ground lights. Critical elements such as Runway Guard Lights (RGL) and stop bars shall be maintained in operation.

Although there is no ICAO Standard sign for Works in Progress, Information signage to provide the air crew with the relevant information regarding the modifications of the operating conditions should be considered. Consulting pilots both, familiar and non-familiar with the airport, will contribute to type a text simple, clear and straight-to-the-point.

Research projects in Europe and in the United States show that a sign displaying "CONSTRUCTION AHEAD" with a safety orange background, located about 150 m prior the beginning of the construction works, increases the situational awareness. It can be supplemented by a sign "END CONSTRUCTION" at the end of the modified section if needed. This temporary information signage, also known as Orange Construction Signs, has been locally adopted as a best practice[8].

Markings can be used as an alternative to signs when it is not possible to install a sign.

Note: *The new edition of ICAO Doc. 9981, PANS Aerodromes due to be published in 2019 will include a dedicated chapter on Works in Progress which will include, among others, procedures pertaining to temporary modifications of the Aerodrome*

Fig 8: Example of 'Orange Construction Sign'.

8. See the references to the websites of the Infrastructure WG of The French-Speaking Airports and the FAA research report in the bibliography. This signage is not an EU or ICAO standard, but a best practice

PREVENTION OF RUNWAY INCURSIONS FROM ROADWAY ACCESSES

Construction projects involve pedestrian activities and roadway traffic on the airfield. These vehicles are often driven by contractors' staff members that are not familiar with the airfield environment.

The construction site should be enclosed within a physical perimeter. This perimeter can be made of orange plastic net, fences, plastic ballasted delineators, or concrete blocks. The perimeter should be continuous as far as practicable for minimizing the risk of incursion from the construction site to the active parts of the manoeuvring area, and especially the runway. For a construction site in the vicinity of an active runway, the signage of the side along the runway strip can be reinforced with roadway signs (No entry, No trespassing, Danger of death, as it is the practice or the roadway standard in the country) intended to increase the awareness of the construction team.

As far as practicable, the construction sites should be directly accessible from the landside/public area, without intersecting or using any service road, taxiway or runway. When the access roads cross or use existing airside service roads, a comprehensive and conspicuous roadway signage should guide the construction vehicles toward the works in order to avoid disorientations.

BRIEFING AND SUPERVISION OF CONTRACTORS WORKS STAFF

Recommendation 1.2.2d: Aerodrome construction contractors' and other personnel working on the airfield should be appropriately briefed (about runway safety/runway incursion prevention) prior to starting work and be properly supervised whilst they are on the aerodrome

As per Recommendation 1.2.2d all contractors should be adequately briefed before they are permitted to access the manoeuvring area. In particular, each driver should be provided with a map clearly displaying the preferred route from the checkpoints to the construction site. Unless very controlled and specific procedures have been agreed with ATC, contractors should be escorted or provided with enclosed routes to sites and not be required to contact ATC directly. Working parties must also be properly supervised.

AERODROME OPERATIONS – PROTECTED AREAS

All staff working on the manoeuvring area should carry an up-to-date airport map/chart, including the protected areas and hot spots, to ensure awareness of areas that may be difficult to navigate correctly. The implied message should be "don't go – danger of death". Operational procedures need to be developed for the protection of these areas.

Protected areas should be clearly delineated on the ground to ensure there is no unintentional trespass. Usually these areas are delineated with red/white plastic chains (metal chains or fences could affect the signals of navigational aids). Some aerodromes also 'burn' a strip in the grass to help drivers see the boundaries more clearly

References and Useful web sites

1) Development and Evaluation of Safety Orange Airport Construction Signage, DOT/FAA/TC-15/52, FAA, November 2015

2) Infrastructure Workgroup of The French-Speaking Airports (Les Aéroports Francophones): https://sites.google.com/site/infraalfaaci/

3) FAA's Airport Construction Advisory Council: https://www.faa.gov/airports/runway_safety/runway_construction/


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APPENDIX M
TECHNOLOGY

Emerging and Future Technologies for the Prevention of Runway Incursions

Air Traffic Control operated technologies

Flight Crew operated technologies

Airside Driver operated technologies

Aerodrome operated technologies

Remote Tower Technologies

RPAS/DRONES Operations on Airports

Future work

References

APPENDIX M EMERGING AND FUTURE TECHNOLOGIES FOR THE PREVENTION OF RUNWAY INCURSIONS

The emergence of new and future technologies to supplement the core runway incursion prevention activities such as compliance with ICAO and EU markings, signs and lighting, standard use of R/T phraseology and, increasingly, the establishment of effective aerodrome local runway safety teams, can provide additional layers of protection and help to reduce the risks of runway incursions and collisions.

It is not the purpose of this document to recommend (directly) the implementation of these technologies – there are other mechanisms (e.g. SESAR Pilot Common Projects) for that. However, the information that follows is intended to raise awareness about the potential safety benefits of these new technologies in the context of the Technology Recommendations, namely:

Rec 1.9.1 Improve situational awareness by adopting the use of technologies that enable operational staff on the manoeuvring area to confirm their location in relation to the runway e.g. via GPS with transponder or airport moving maps, visual aids, signs etc.

and

Rec 1.9.2 Promote the integration of safety nets to provide immediate and simultaneous runway and traffic proximity alerts for Pilots, Air Traffic Controllers and Manoeuvring Area Vehicle Drivers.

What follows is a list (and useful links) of some of the existing, new and emerging technologies that are available, or will be in the future, that support Recommendations 1.9.1 and 1.9.2:

Note: *Technologies marked with an * are included in the SESAR Solutions Catalogue (High Performing Airport Operations section). More details can be found at:*
https://www.sesarju.eu/sites/default/files/solutions/SESAR_Solutions_Catalogue.pdf

AIR TRAFFIC CONTROL OPERATED TECHNOLOGIES

Stop Bars

The operational use of stop bars is described in Appendix E (ANSP) whilst the aerodrome/ATC use policy and implementation considerations are covered in Appendix J.

Advanced Surface Movement Guidance and Control System (A-SMGCS)

A-SMGCS covers applications and systems for the air traffic controller, vehicle drivers, airport operators and pilots. Already operationally available systems offer:

- Controller surveillance display including position and identification of suitably equipped vehicles;
- Runway incursion alerts for the controller;
- Selective switching of taxiway lights including stop bars at Intermediate holding positions;
- Routing and guidance services and;
- Runway protected areas penetration alerts and runway occupied alerts for the vehicle driver and controllers

* ATC Airport Safety Nets as part of Airport Safety Support Systems:

The introduction of electronic flight strips in many control towers means that instructions given by a controller are available electronically and can be integrated with other data such as flight plan, surveillance, routing and published rules and procedures. The integration of this data allows the system to monitor the information and alert the controller when inconsistencies are detected. This technology highlights potential conflicts much sooner than the current practise of relying on surveillance data to trigger an alarm. Two types of alerts are supported:

- Conflicting ATC Clearances – e.g. line-up and landing clearances given on the same runway.
- Conformance Monitoring Alerts – detecting cleared route violations by aircraft.

* **'Follow the Greens'**

Airfield ground lighting offers a unique opportunity to guide aircraft and vehicles around the airport. London Heathrow Airport has successfully used 'Follow the Greens' operations for many years and has been approved in the SESAR project for wider roll-out across European airports in the future to add full automation to it through the use of the routing service.

FLIGHT CREW OPERATED TECHNOLOGIES

* **Aerodrome moving map displays for pilots and**
* **Taxi route display for pilots**

Navigating the route between the departure gate and the runway can be complex and becomes harder during reduced-visibility conditions or at night. To provide extra guidance in addition to today's airfield signage and ground lighting it is possible to present a graphical display of the taxi route instructions received from air traffic control thus giving another means for the fight crew to check they are following the right route. The on-board moving map of the airfield can be overlaid with the taxi route sent via data link so the pilot can see exactly where the aircraft is in relation to the cleared route.

Runway Awareness and Advisory System (RAAS) Smart Runway and Smart Landing

SmartRunway & SmartLanding is a development of the Runway Awareness and Advisory System (RAAS) and is available on later-model Enhanced Ground Proximity Warning Systems. It provides information to pilots on (which) runway is ahead both airborne and on the ground.

Runway Awareness and Advisory Systems use airport data stored in the EGPWS database, coupled with GPS and other on-board sensors, to monitor the movement of an aircraft around the airport. It provides visual/aural annunciations at critical points, such as "Approaching Runway 09 Left and confirmation when an aircraft is lined up on the runway prior to take-off: for example, "On Runway 09 Right, 2,450 metres remaining." In a scenario where a crew inadvertently lines up on a parallel taxiway and commences a take-off, an aural alert "On Taxiway, On Taxiway" is provided if the aircraft speed exceeds 40 kts, 74.08 km/h or 20.56 m/s.

Advisories/cautions are generated based upon the current aircraft position when compared to the location of the airport runways, which are stored within the EGPWS Runway Database. These advisories include:

- Approaching Runway – An 'In Air' advisory provides the crew with awareness of which runway the aircraft is lined up with on approach.
- Approaching Runway – An 'On-Ground' advisory provides the flight crew with awareness of approximate runway edge being approached by the aircraft during taxi operations
- On Runway advisory provides the crew with awareness on which runway the aircraft is lined-up.

AIRSIDE DRIVER OPERATED TECHNOLOGIES

* **Aerodrome moving map displays for drivers**

Busy airports monitor airfield activity using a range of sensors and tracking systems. This information can also be used by vehicle drivers to improve safety. By fitting a screen in the vehicle, the driver can access an airport moving map, can see information regarding surrounding traffic, and can receive alerts if a dangerous situation arises. Warnings can include those related to possible collisions with an aircraft on a runway or taxiway, infringements of a runway, or a closed or restricted area.

AERODROME OPERATED TECHNOLOGIES

Autonomous Runway Incursion Warning System (ARIWS)

ARIWS have been developed to deliver automatic (independent from ATC) warnings and runway status indications to pilots and manoeuvring area vehicle drivers.

- ***Runway Status Lights (RWSL)** is an example of an ARIWS. A brief description of how ARIWS work and the essential key actions expected of pilots and drivers on seeing red RWSL can be found in Appendix J. In Europe, RWSL have been deployed at Paris Charles De Gaulle Airport since 2016; see http://www.eurocontrol.int/runway-status-lights and a video presentation at https://youtu.be/KkQilJfOPYw for more details.

Final Approach Runway Occupancy Signal (FAROS) and (eFAROS

FAROS is an FAA-sponsored concept, which is being deployed for operational evaluation in the USA, along with other elements of the system of Runway Status Lights.

It works by providing a visual signal to aircraft on final approach to land that the runway ahead is occupied by another aircraft or a vehicle. This is done by adapting the PAPI or VASI system to alter from steady lights to flashing mode whilst the identified hazard remains. Externally, the PAPI or VASI system is unaltered and continues to function normally in its primary role as an angle of approach awareness indicator whether or not a FAROS input has temporarily caused the flashing mode to activate.

*REMOTE TOWER TECHNOLOGIES

The remote tower concept is a capability whereby aerodrome or tower control is provided by air traffic controllers situated in a remote control room rather than from the traditional ATC tower located on the aerodrome.

The prime role and functions of the aerodrome or tower controller remains unchanged in the remote tower environment, i.e. to control aircraft operating on or around the aerodrome primarily, but not exclusively, via a visual lookout over the aerodrome. In remote tower operations, however, this view may be supplemented (enhanced) using high fidelity day/night cameras with, for instance, a pan-tilt-zoom and/or binocular capability. These cameras can also provide visual target tracking which can detect the motion of an object, such as light aircraft, RPAS/drone and vehicles which may not be equipped with a transponder (non-cooperative targets). Infrared sensors can also provide improved 'visual acuity' in particular during low visibility conditions and/or at night. Surveillance target tracking (STT) which refers to the use of positioning sensors such as an A-SMGCS to determine the location of 'co-operative' targets, can also be provided to remote tower controllers as another means of tracking aircraft and vehicles on the aerodrome.

ANSP and controller interfaces with aerodrome local runway safety teams should be agreed to ensure that the essential ATC input to these runway incursion prevention working arrangements is not reduced as a result of remote tower ATC operations.

RPAS/DRONES OPERATIONS ON AIRPORTS

The rapidly growing Remotely Piloted Aircraft Systems (RPAS) or 'drone' market may also impact future aerodrome operations. For instance, there is the possibility that RPAS/drones may be used to facilitate inspections of aerodrome surfaces and other infrastructure. Moreover, they could be used as an alternative platform for conducting aerodrome navigational aids (e.g. ILS) flight checking operations. Clearly, any operations involving RPAS/drones on or around aerodromes will need to be carefully controlled and coordinated to ensure they do not have a negative impact on safe runway operations

FUTURE WORK

It will be incumbent of international and regional aviation organisations to carefully monitor the development of these emerging technologies to ensure that any possible runway incursion related risks that could be associated with their introduction is properly assessed and managed.

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APPENDIX N
INTERPRETING EVENTS – RUNWAY INCURSION?

Table to Assist in Determining if a Runway Incursion has occurred

Protected Area and Runway End Safety Area considerations

Controller Clearance

Defined Distances (for determining runway incursions)

Just Culture

APPENDIX N
INTERPRETING EVENTS – RUNWAY INCURSION?

The purpose of this Appendix is to aid interpretation of runway events using the ICAO definition of runway incursion introduced in November 2004 which is:

"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"

Whilst the definition has been widely accepted - and no change to it is proposed - it has become very apparent that determining whether an event is a runway incursion or not is still very subjective and opinions vary considerably.

In an attempt to provide additional clarity and consistency of interpretation of the ICAO definition, this edition of the EAPPRI contains an expanded table of runway incursion and/or runway safety events as assessed by a representative working group of aviation stakeholders.

This aid to interpretation will not guarantee complete consistency but will increase the level of uniformity from the current situation. The following explanations are intended to provide further clarification to ease common understanding of this definition:

"Incorrect presence" This should be interpreted as the unsafe, unauthorised or undesirable presence, or movement of, an aircraft, vehicle or pedestrian.

"Protected area of a surface designated for the landing and take-off of aircraft".
This is to be interpreted as the physical surface of a runway, from the centreline to the holding point appropriate to the type of runway. Where operations are being conducted during Low Visibility operations this should be the holding point appropriate to the procedures in force.

Note: *Further considerations about the Protected Area are covered later in this appendix.*

Whether they are interpreted as runway incursions or not, **all runway related safety events should be reviewed/ investigated,** in order to learn lessons and put measures in place to prevent recurrence. It is through this process that safety improvements can be made.

Crossing a red stop-bar does not necessarily mean a runway incursion. However, the working group strongly supports that the message **"never cross a red stop bar"** is widely disseminated and practised.

TABLE TO ASSIST IN DETERMINING IF A RUNWAY INCURSION HAS OCCURRED

Example	Runway Safety; Runway Incursion	Runway Safety Event; Not Incursion	Rationale
An aircraft vehicle or pedestrian is cleared correctly to enter or cross a runway and proceeds as cleared but does not read back the clearance		Yes	There is no incorrect presence. Failing to read back does not create an incursion.
An aircraft is cleared correctly to land or take-off and proceeds as cleared, but does not read back the clearance.		Yes	There is no incorrect presence Failing to read back does not create an incursion.
Aircraft lands without clearance being issued by the controller	Yes		This is an incorrect presence.
Aircraft lands without clearance being received by the flight crew, having been issued by ATC.		Yes	If ATC have given the clearance, there is no incorrect presence.
Aircraft lands without clearance being received by the flight crew, after a go-around instruction from ATC.	Yes		Once a go-around instruction is given it is an incorrect presence to land on the runway.
Aircraft lands without clearance and evidence shows that the pilot was acting appropriately in accordance with Loss of Communication procedures due to R/T failure.		Yes	
Aircraft takes off without clearance	Yes		TThe aircraft was only cleared to line up. Thus it is an incorrect presence once take-off is commenced.
An aircraft vehicle or pedestrian enters runway without clearance	Yes		This is an incorrect presence.
An aircraft, vehicle or pedestrian is cleared to enter the runway and does so as instructed and intended, but before the red stop bar has been "dropped". (This also applies to traffic lights where so positioned)		Yes	There is no incorrect presence as ATC clearance to enter has been given. However, **pilots/drivers shall not cross illuminated red stop bars**. If the stop bar does not extinguish, pilots and drivers must check with the controller before proceeding.
An aircraft, vehicle or pedestrian crosses a red stop-bar without ATC	Yes		It is an incorrect presence

Example	Runway Safety; Runway Incursion	Runway Safety Event; Not Incursion	Rationale
clearance			
An aircraft vehicle or pedestrian enters the runway at the incorrect holding point.	Yes		At this location on the runway it is an incorrect presence.
An aircraft vehicle or pedestrian vacates the runway at the incorrect holding point.		Yes	There is no incorrect presence on the runway
Controller incorrectly clears an aircraft, vehicle or pedestrian to enter or cross a runway and the runway is entered. I.e. the controller issues a clearance he wouldn't have issued if he was conscious of the whole situation.	Yes		It is the movement onto the runway or protected area that creates the incorrect presence – not the incorrect RT transmission. The RT transmission does not mean an RI occurs at that moment.
Controller incorrectly clears an aircraft to land or take-off. I.e. the controller issues a clearance he wouldn't have issued if he was conscious of the whole situation.	Yes		It is an incorrect presence. It is the movement onto the runway or protected area that creates the incorrect presence – not the incorrect RT transmission. The RT transmission does not mean an RI occurs at that moment.
Aircraft lines up out of sequence	Yes		It is an incorrect presence
Taxiway green lights are selected along a route onto the runway but the ATC clearance is only part way along that route and the a/c or vehicle proceeds on to the runway beyond the stated clearance limit.	Yes		It is an incorrect presence
Two aircraft are correctly present on the runway after lining up: one for full length departure at the beginning of the runway and the other for an intersection take-off. The controller erroneously gives a take-off clearance to the aircraft at the beginning of the runway. The pilots of the aircraft realise the error, communicate it with the controller and do not start to move.		Yes	There is no incorrect presence.
Two aircraft are correctly present on the runway after lining up: one for full length departure at the beginning of the runway and the other for an intersection take-off. The controller erroneously gives a take-off clearance to the aircraft at the beginning of the runway. The pilots of the aircraft do not realise the error and the full length departure starts to roll.	Yes		It is an incorrect presence

Example	Runway Safety; Runway Incursion	Runway Safety Event; Not Incursion	Rationale
An aircraft is cleared to take-off and a vehicle is on the runway correctly and the pilot recognises the situation and refuses to move.		Yes	There is no incorrect presence
An aircraft is cleared to take-off and a vehicle is on the runway correctly and the aircraft commences its take off roll.	Yes		It is an incorrect presence once the aircraft begins its take-off roll.
Aircraft, vehicle or pedestrian crosses a red stop bar but stays outside of the protected surface of the runway (e.g. stop bar at Cat III position but Low Visibility conditions not present)		Yes	No incorrect presence on the runway or protected area. However, **pilots/drivers shall not cross lit red stop bars and shall check with the controller**.
An aircraft taxies up to a runway holding point and stops, with all undercarriage short of the holding point but the nose/radome is beyond the holding point.	Yes		It is an incorrect presence
During Cat III operations a vehicle enters the Cat III runway strip without ATC clearance.	Yes		It is an incorrect presence
During Cat I operations a vehicle enters the Cat I runway strip without ATC clearance.	Yes		It is an incorrect presence
A vehicle convoy is cleared by ATC to enter the runway, but the stop-bar comes back on before the last vehicle has crossed the holding point.		Yes	As the convoy was cleared to enter, there is no incorrect presence. However, **pilots/drivers shall not cross lit red stop bars and shall check the status of the stop bar with the controller before proceeding**.
A pilot lands an aircraft on a runway NOTAM'd as closed.		Yes	If the runway is NOTAM'd as closed, it is not a runway.
Two airfield ops vehicles and 2 fire service vehicles call ATC and obtain permission to enter the runway correctly which is done. Another vehicle joins the back of the convoy without communication and 5 vehicles cross the runway.	Yes		In this example the 5th vehicle is an incorrect presence.
At night a departing aircraft is given a conditional line up clearance at the correct holding point which is read back correctly. The aircraft enters the runway at the correct time in terms of the conditional clearance, but in doing so crosses a lit stop-bar.		Yes	There was no incorrect presence. However, **pilots/drivers shall not cross lit red stop bars and shall check the status of the stop bar with the controller before proceeding.**

Example	Runway Safety; Runway Incursion	Runway Safety Event; Not Incursion	Rationale
An aircraft enters the runway correctly but faces in the wrong direction (e.g. cleared to enter runway 23 but lines-up facing 05 direction) and starts its roll.	Yes		It is an incorrect presence once it starts take-off roll.
The TWR controller erroneously clears an incorrect aircraft for take-off. He immediately realises his error and corrects the clearance. The aircraft does not move and remains at the holding point.		Yes	There is no incorrect presence
A helicopter flies or ground taxies along part of the runway length without clearance to do so.	Yes		It is an incorrect presence
An aircraft is cleared to enter the runway after a landing clearance has been given to another aircraft.		Yes	The RT clearance does not mean an incursion has immediately happened.
An aircraft is cleared to enter the runway and does so, after a landing clearance has been given to another aircraft.	Yes		It is an incorrect presence

PROTECTED AREA: ILS AREA/ZONES AND RUNWAY END SAFETY AREA CONSIDERATIONS

The protected area as a minimum includes the runway and strip distance out to the holding points relevant to the visibility conditions at the time.

ILS Critical and Sensitive Areas/Zones

According to Commission Regulation (EU) No 139/2014 GM (carried over from EAPPRI Edition 2.0) "The "protected surface" includes the ILS glide-path and localiser critical areas at all times, and the ILS sensitive areas during Low Visibility Procedures". However, a number of studies have concluded that the ILS areas/zones do not always need to be part of the protected area. Similarly, the EAPPRI working group was also unable to agree if an aircraft, vehicle or pedestrian entering the ILS LOC or GP critical area is an incursion or not. Thus it is recommended this decision is made jointly between the ANSP and the aerodrome operator for each airport. The result should be depicted on the Aerodrome Protected Area map – see Recommendation Aerodrome Operator 1.2.17a.

RESA

The ICAO Runway Safety Handbook includes the RESA in its description of the protected area. Notwithstanding this, previous studies also showed that there is no consensus regarding the inclusion of the RESA as part of the protected area and whether penetration of them constitutes a runway incursion or not. The EAPPRI working group opinions were equally divided and again it is suggested that the decision to include or exclude RESAs from the protected area is made jointly between the ANSP and the airport operator for each airport. As above, if RESAs are included they should be shown on the Protected Area map.

CONTROLLER CLEARANCE

The issuing of an erroneous RT clearance by the controller does not automatically mean that an incursion has happened at that precise moment – an incursion happens when the aircraft/vehicle/pedestrian actually moves onto the runway/protected area. It is at this point that the presence is incorrect.

DEFINED DISTANCES (FOR DETERMINING RUNWAY INCURSIONS)

The working group was unable to agree on defined distances between, for example, a departing aircraft followed by a landing aircraft – when are they "too close" and a runway incursion is deemed to have occurred? For instance, if the departing aircraft gets airborne when a landing aircraft is at 4nm, 3nm, 2nm, 1nm…. at what point does an incursion occur?

The recommendation from the group is not to define pan-European distances to apply everywhere as various ANSPs and airports have different methods in use. The group agreed, however, to recommend that each airport and ANSP should jointly agree distances that apply at that airport. Thus a local solution is proposed not a "one-size-fits-all." The local solution should be safety assessed and if there is no local solution then PANS-ATM Chapter 7 (7.9, 7.10 and 7.11) criteria should be used.

Example	Runway Safety; Runway Incursion	Runway Safety Event; No Incursion	Rationale
Landing aircraft followed by landing aircraft	Within defined position of both aircraft	Outside defined position of both aircraft	Only within the defined distance is it an incursion.
Landing aircraft followed by departing aircraft			
Departing aircraft followed by departing aircraft			
Departing aircraft followed by landing aircraft			
A vacating aircraft followed by a landing aircraft			
A vacating aircraft followed by a departing aircraft			
An aircraft is given a clearance to land with a vehicle on the runway that has received a correct clearance to be on the runway.	Yes – if the landing aircraft is within the defined distances above.	Yes – if the landing aircraft is not yet inside the defined distance above.	There is only an incorrect presence once the landing aircraft is within the defined distance.
An aircraft is departing and a landing aircraft commences a go-around. This may result in a loss of separation.	Yes – if the go-around commences within the defined distance	Yes – if the go-around occurs before the aircraft is inside the defined distance above.	There is only an incorrect presence once the landing aircraft is within the defined distance.

JUST CULTURE

To further aid learning lessons from events the working group recommend that being involved in a runway incursion does not imply blame or error – it can be the situation that is classed as the incursion. This supports a Just Culture philosophy.

APPENDIX O
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Chap 10	Information for air traffic services, search and rescue services and aeronautical information services
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Annex 4 - Aeronautical Charts	
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Chap 4. 17	Aeronautical Data
Chap 13	Aerodrome/Heliport Chart
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