ICAO

SAFETY

Runway Safety Programme – Global Runway Safety Action Plan

Second Edition, February 2024

Contents

Background

Since the first ICAO Global Runway Safety Symposium held in Montréal, Canada, in May 2011, ICAO and the Runway Safety Programme (RSP) Partners have been working together to minimize and mitigate the risks of runway incursions, runway excursions and other events linked to runway safety.

The ICAO runway safety programme involves substantial collaboration with partner organizations including: Airports Council International (ACI); the Civil Air Navigation Services Organisation (CANSO); the European Aviation Safety Agency (EASA); European Organisation for the Safety of Air Navigation (EUROCONTROL); the United States Federal Aviation Administration (FAA); the Flight Safety Foundation (FSF); the International Air Transport Association (IATA); the International Council of Aircraft Owner and Pilot Associations (IAOPA); the International Business Aviation Council (IBAC); the International Coordinating Council of Aerospace Industries Associations (ICCAIA); the International Federation of Airline Pilots' Associations (IFALPA); and the International Federation of Air Traffic Controllers' Associations (IFATCA), the UK CAA, as well as the ICAO Regional Offices.

In January 2017 the RSP Partners established a Runway Safety Action Plan Working Group (RSAP-WG) with the aim of reviewing the RSP achievements, objectives and priorities, and to develop a global runway safety action plan, to be unveiled at the Second Global Runway Safety Symposium in Lima, Peru, 20-22 November 2017. The objectives of the RSAP-WG included:

- Review runway related accident and serious incident data;
- Conduct a safety risk assessment of runway safety accident occurrence categories;
- Identify the runway safety risk priorities and high risk accident categories;
- Identify appropriate global mitigation actions; and
- Develop a Global Runway Safety Action Plan (GRSAP).

Through a review and analysis of runway safety occurrence data and risk analysis, the RSAP-WG identified runway excursions and runway incursions as the main high-risk occurrence categories. This GRSAP provides recommended actions for all runway safety stakeholders, with the aim of reducing the global rate of runway excursions and runway incursions. Initially published in 2017, it was reviewed by the RSP partners in 2022, with updates and improvements resulting in the publication of a revised version in February 2024.

Runway Safety Teams

The RSP promotes the establishment of Runway Safety Teams (RSTs) at airports as an effective means to reduce runway related accidents and incidents. The requirement for airports to establish a RST was one of the main outcomes of the first ICAO Global Runway Safety Symposium. The establishment of effective RSTs has helped to significantly reduce the runway safety related risks globally since 2011, and is now included in ICAO's PANS-Aerodromes as a key responsibility of an aerodrome operator.

Hence, the RSP Partners continue to support the establishment of effective RSTs through Runway Safety Go-Team Missions. To request a Runway Safety Go-Team Mission please visit https://www.icao.int/safety/RunwaySafety or contact your ICAO Regional Office.

Other ICAO Initiatives

ICAO continues to take other initiatives related to improving runway safety. For example, in November 2021 the Global Reporting Format for runway surface conditions ('The GRF') became applicable worldwide. This new methodology will significantly reduce the risks associated with runway contamination, which is one of the leading contributing factors of runway excursions.

The third edition of ICAO PANS-Aerodrome (Doc 9981), which incorporates a dedicated chapter on Runway Safety, was published in November 2020. The dedicated chapter addresses topics such as causal factors, RST and incursion 'Hot Spots', complementing the pre-existing runway safety-related content of other chapters (such as FOD, the GRF, WIP etc.).

ICAO also maintains its Safety Management Programme activities, key elements of which are the ICAO Safety Management Manual (SMM) (Doc 9859), the Safety Management Implementation (SMI) website, State Safety Programme (SSP) tools as well as Safety Management Regional Symposia and Workshops.

Global Priorities for Runway Safety

The ICAO Global Aviation Safety Plan (GASP) identifies runway safety as a global safety priority. Runway safety-related events as defined in the GASP and ICAO Annual Safety Report, include the following ICAO accident occurrence categories:

- Abnormal Runway Contact
- Ground Collision
- Runway Excursion
- Runway Incursion
- Loss of Control on the Ground
- Collision with Obstacle(s)
- Undershoot / Overshoot

The ICAO definitions of each runway safety occurrence category can be found in Appendix 1 of this action plan.

In line with safety management principles, in 2017, the RSAP-WG conducted an analysis of available runway safety accident and serious incident data and undertook a risk assessment to identify the runway safety high-risk categories, in order to prioritize the efforts of the Runway Safety Programme.

The result of the RSAP-WG analysis identified runway excursions as the highest risk category.

The validity of this analysis was reviewed and confirmed by the RSP partners during their 2022 review.

In 2017 ICAO and Runway Safety Partners also identified runway incursions as a high risk category. Although the number of runway incursion accidents reported is very low, the number of runway incursion incidents remains high (at a rate of one report per day according to IATA STEADES data). There is a very high fatality risk associated with runway incursion accidents. The collision between two B747s at Los Rodeos Airport, Tenerife, in 1977, was the result of a runway incursion and remains the worst accident in aviation history, with the highest number of fatalities.

The validity of this analysis was also reviewed and confirmed by the RSP partners during their 2022 review.

Hence, this action plan continues to limit its scope to focus upon actions relating to runway excursions and runway incursions, whilst also considering post-COVID aspects such as 'skill fade'.

However, the other runway safety categories should not be overlooked. Aerodrome RST and safety management systems should continue to focus on all of the runway safety categories.

This action plan provides recommended actions for runway stakeholders, including ICAO, the runway safety programme partners, State Civil Aviation Authorities, Regional Safety Oversight Organisations (RSOOs), Regional Aviation Safety Groups (RASGs), aircraft operators, aerodrome operators, air navigation service providers and aerospace industry. The actions are aimed at reducing the global rate of runway excursions and runway incursions. However, regions, States and industry may have their own unique challenges, and therefore the actions are not all encompassing. States, regions and industry should conduct their own regular risk analyses to identify their own operational safety risks and appropriate mitigations.

Runway Excursion and Runway Incursion Top Contributing Factors

The following tables present the top contributing factors for runway excursions and runway incursions. In 2017 the RSAP-WG identified these contributing factors by reviewing available data and information provided by RSP partners as well as through expert assessment.

An analysis of runway excursion contributing factors performed by IATA and shared with the RSAP-WG was utilized as the basis for identifying the runway excursion contributing factors. Runway excursions, as per IATA, include landing overruns, take-off overruns, landing veer-offs, take-off veer-offs and taxiway excursions. IATA, through the Accident Classification Technical Group (ACTG), assigns contributing factors to runway/taxiway excursion accidents to better understand the correlations. Those common runway excursions contributing factors follow the Threat and Error Management (TEM) framework. The contributing factors can be found in IATA's Annual Safety Report.

The contributing factors identified in 2017 were reviewed by the RSP in 2022, resulting in some updates and revisions.

The references used for the 2017 analysis and 2022 review can be found in Appendix 3.

Runway Excursion Top Contributing Factors

Contributing Factor	Description / Examples
Latent Conditions – *Conditions present in the system before the accident and triggered by various possible factors.*	
Flight Operations: Standard Operating Procedures and Checking	Absent, inadequate or ineffective: • Standard Operating Procedures (SOPs) • Operational instructions and/or policies • Company regulations • Controls to assess effective implementation and compliance with regulations and SOPs SOP not applied by flight crew.
Flight Operations: Training	Inadequate or ineffective training of flight crews. Training does not effectively address runway excursion risks and mitigations, including: • Approach path management • Performance calculations for landing/take-off • Human factors/performance • Lessons learnt from incidents/events • SOP • Performance based/evidence-based training
Regulatory Oversight	Inadequate or ineffective regulatory oversight by the State, including: • Absent or inadequate regulations • Inadequate inspection, audit or monitoring capacity
Safety Management	Absent or ineffective safety management, such as an absence of: • Safety policy and objectives • Safety risk management (including hazard identification process) • Safety assurance processes and procedures (including quality management) • Safety promotion activities • Positive corporate safety culture • Use of Flight Data Monitoring (as part of safety management).
Threat – An event or error outside the influence of the flight crew, but requiring their attention and management. ***Mismanaged threat: A threat linked to or inducing a flight crew error.***	

Contributing Factor	Description / Examples
Meteorology	Includes thunderstorms, reduced visibility, cloud base, crosswind, tailwind, wind shear, turbulence, gusty wind and icing conditions, heavy precipitation combined with: • Unfamiliarity with local conditions • Inadequate procedures or training to anticipate and react to abnormal conditions • Flight crew inexperience • Operational pressures/procedures
Airport Facilities	Deficiencies associated with management or maintenance of airport facilities, including: • Poor braking action because of contaminated runways/taxiways. • Unprotected or mismanagement of ILS critical and sensitive areas • Management of navigation aids/facilities • Management and status of visual aids • Management of 'work in progress'
Flight Crew Error (Active Human Performance) – An observed flight crew deviation from organizational expectations or crew intentions. ***Mismanaged error: An error that is linked to or induces additional error or an undesired aircraft state.***	
Failure to abandon unstable approach	Flight continues with an unstable approach: • Failure to recognize an incipient or actual unstable approach • Failure to take go-around decision
Manual Handling/Flight Controls	Deficient flying skills in areas such as: • Hand flying vertical, lateral, or speed deviations • Management of approach deviations, lateral and vertical • Incorrect flaps, speed brake, autobrake, thrust reverser or power settings • Surface manoeuvring, leading to missed runway/taxiway, failure to hold short, taxi above speed limit
Standard Operating Procedures (SOP) Adherence	Poor application of SOP leading to: • Intentional or unintentional failure to cross-check (automation) inputs • Intentional or unintentional failure to follow SOPs • Uncoordinated changes to flight management, autopilot, auto throttle and other flight control systems • Sterile cockpit violations
Undesired Aircraft Condition (UAC) – A flight-crew-induced aircraft state that clearly reduces safety margins; a safety-compromising situation that results from ineffective error management. An undesired aircraft state is recoverable. ***Mismanaged UAC – A condition that is linked to or induces additional flight crew errors.***	

Contributing Factor	Description / Examples
Unstable Approach Condition	Comprises vertical, lateral or speed deviations during the portion of flight close to landing (final approach, including curved approaches): • Flight crew do not recognise a single or combination of factors that may lead to an UAC • Flight crew do not recognise an UAC Flight crew unable to manage incipient or actual UAC
Landing Deviations	Includes long, floated, bounced, firm, off-centre or crabbed landings: • Flight crew do not recognise incipient or actual landing deviation • Flight crew unable to manage incipient or actual landing deviation

Runway Incursion Top Contributing Factors

Contributing Factor	Description / Examples
Latent Conditions – *Conditions present in the system before the accident and triggered by various possible factors.*	
Training	Includes inadequate training for air traffic controllers, pilots and/or airside vehicle drivers: • Training does not effectively address runway incursion risks and mitigations • Competency-based training and assessment not applied
Procedures	Inadequate, inappropriate or absent procedures for ATC, flight-crew and vehicle drivers
Regulatory Oversight	Inadequate or ineffective regulatory oversight by the State, including: • Absent or inadequate regulations • Inadequate inspection, audit or monitoring capacity
Safety Management	Absent or ineffective safety management for airport operators, aircraft operators and ATC, such as an absence of: • Safety policy and objectives • Safety risk management (including hazard identification process) • Safety assurance processes and procedures (including quality management) • Safety promotion activities • Positive corporate safety culture

Contributing Factor	Description / Examples
Aerodrome Design	Complex or inadequate aerodrome design such as: • Complexity of the layout of roads and taxiways adjacent to the runway • Intersecting/crossing runways • Insufficient spacing between parallel runways • Runway entrances not perpendicular to runway • No end-loop perimeter taxiways to avoid crossings • Inadequate, obscured or poorly maintained visual aids (including signs, marking and lighting) Poorly maintained runway surface with inadequate friction characteristics

Workplace Conditions	Issues such as:
	• Flight crew:
	  ○ maintaining 'sterile cockpit' environment when taxiing
	• Air Traffic Controllers:
	  ○ Inability to continuously observe manoeuvring area visually or systems such as A-SMGCS
	  ○ Secondary tasks or activities that distract
	• Vehicle drivers:
	  ○ Distractions (task or equipment) while driving

Threat – An event or error outside the influence of the flight crew, but requiring their attention and management.	
Meteorology	Includes poor visibility, rain, snow and icing conditions (that may obscure visual aids and hinder visual observation) Misjudgement of weather impact on airport infrastructure, aircraft and airport systems and human performance
Active Human Performance – Human Performance Limitations (directly related to OSF and CC) including false perceptions; memory lapses; and reduced situational awareness.	
Pilot Factors	Includes inadvertent misunderstanding and non-compliance with ATC instructions, in particular take-off or landing without clearance.
Airside Vehicle Driver Factors	May include not obtaining a clearance, misunderstanding or non-compliance with ATC instructions Inability to maintain situational awareness
Air Traffic Controller Factors	May include clearing aircraft to land/depart on an occupied runway, failure to monitor aircraft position on approach and clearing aircraft to cross a runway when other aircraft on departure/landing roll.
Communication Errors	A breakdown in communications between air traffic controllers and pilots or airside vehicle drivers: • Failure to use standard phraseology • Failure in read-back/hear-back Transmission of instructions during periods of heavy workload (e.g. early stages of a go-around)

Runway Safety Recommended Actions

The following tables contain the global runway safety recommended actions identified by the RSAP-WG (initial 2017 version of the action plan) and reviewed by the RSP Partners in early 2022 (revised version of the action plan). The actions are intended to assist runway safety stakeholders in reducing their risks related to runway excursions and runway incursions. Each table identifies the mitigation actions for each stakeholder and associates the actions with the top contributing factors.

The timelines for the actions are categorized by colour into short-term actions and medium-term actions. Those actions without a colour indicator are considered to be on-going actions or best practices. The colour categorization is indicated in the table below (revised in 2022).

	Target	Colour indicator
Short-Term	By 2027	
Medium-Term	By 2029	

Stakeholder	**ICAO**	
Runway Safety Priority	**Runway Excursions, Runway Incursions**	
Actions	**Action**	**Related Contributing Factor (if applicable)**
	1. Actively Coordinate the ICAO Runway Safety Programme. 2. Update and enhance Assembly Resolutions related to runway safety. 3. Develop runway safety standards and recommended practices for inclusion in ICAO Annexes. 4. Maintain PANS-Aerodromes (Doc 9981) to include additional provisions relating to runway safety. 5. Review and update the Universal Safety Oversight Audit Programme (USOAP) Protocol Questions related to runway safety. 6. Review, enhance and consolidate, as appropriate, ICAO recommended practices related to runway safety, such as the Manual on the Prevention of Runway Incursions (Doc 9870), ICAO Runway Safety Team Handbook, Runway Safety Go-Team Methodology etc. 7. Review and develop, as appropriate, runway safety recommended practices related to runway excursions. 8. Review and develop, as appropriate, guidance to States on the implementation of State Runway Safety Programmes. 9. Review and develop, as appropriate, ICAO aviation training related to runway safety, including for runway excursion prevention. 10. Maintain and enhance the ICAO runway safety website and I-Kit. 11. Conduct Regional runway safety Symposia and workshops. 12. Develop tools to collate, monitor and share runway safety data, including ICAO integrated Safety Trend Analysis and Reporting System (iSTARS) applications.	**Latent Conditions** Training Regulatory Oversight Safety Management
	13. Continue to support a harmonized deployment of the Global Reporting Format for assessing and reporting runway surface conditions in accordance with Annex 14 Vol I (Applicability date 4 November 2021).	**Threats** Contaminated runway/taxiway
References	ICAO Annex 14 Vol I ICAO PANS-Aerodromes (Doc 9981)	

	ICAO Manual on the Prevention of Runway Incursions (Doc 9870) ICAO Safety Management Manual (Doc 9859) ICAO Aerodrome Design Manual, Part 1 — Runways (Doc 9157) ICAO Aerodrome Design Manual, Part 4 — Visual Aids (Doc. 9157) ICAO Runway Safety Team Handbook Second Edition Runway Safety IKit (www.icao.int/safety/RunwaySafety)

Stakeholder	**Runway Safety Programme Partners**	
Runway Safety Priority	**Runway Excursions, Runway Incursions**	
Actions	**Action**	**Related Contributing Factor (if applicable)**
	1. Identify global runway safety priorities and collaborate on runway safety activities. 2. Continue to convene Runway Safety Programme Partner meetings at least annually. 3. Continue to collaborate on the monitoring of runway safety related data (both lagging and leading), share data, conduct risk analysis and identify appropriate mitigations. 4. Promote runway safety best practices and conduct awareness campaigns as appropriate. 5. Disseminate, promote and support implementation of the Global Runway Safety Action Plan. 6. Organize a global runway safety event at least every six years.	**General Actions**
	7. Actively engage in RASG safety risk management activities related to runway safety. 8. Support Runway Safety "Go-Teams", both physical and virtual (in accordance with Go-Team methodology). 9. Continue to support the establishment of effective Airport Runway Safety Teams (RST).	**Latent Conditions** Regulatory Oversight
References	ICAO PANS-Aerodromes (Doc 9981) ICAO Safety Management Manual (Doc 9859) ICAO Manual on the Prevention of Runway Incursions (Doc 9870) ICAO Runway Safety Team Handbook Second Edition Runway Safety IKit (www.icao.int/safety/RunwaySafety)	

<table>
<tr><td>Stakeholder</td><td colspan="2">Regional Safety Oversight Organisations (RSOOs) and Regional Aviation Safety Groups (RASGs)</td></tr>
<tr><td>Runway Safety Priority</td><td colspan="2">Runway Excursions, Runway Incursions</td></tr>
<tr><td>Actions</td><td>Action</td><td>Related Contributing Factor (if applicable)</td></tr>
<tr><td></td><td>1. Continuously collect and regularly analyse available regional safety data to identify trends, risks and contributing factors.

2. Develop and implement regional action plans and develop the means to measure implementation/effectiveness. For example, RASGs shall develop:
a) Safety Enhancement Initiatives (SEIs)
b) Detailed Implementation Plans (DIPs)
c) Relevant safety performance indicators (lagging and leading).

3. Monitor, manage and maintain regional action plans, including:
a) Review resources (expertise, capital, systems) requirements
b) Facilitate partnerships between regional stakeholders (States, industry, RSOO/PIRGs)
c) Support, coordinate and monitor the implementation of relevant ICAO SARPs.

4. Identify States that may require support and ensure such support offered.</td><td>General Actions</td></tr>
<tr><td>References</td><td colspan="2">ICAO Safety Management Manual (Doc 9859)
Runway Safety IKit (www.icao.int/safety/RunwaySafety)
ICAO RASG Website (www.icao.int/safety/Implementation/Lists/RASGSPIRGS)
ICAO RSOO Website (www.icao.int/safety/Implementation/Lists/COSCAP_RSOO)
The CAST/ICAO Common Taxonomy Team Website (www.intlaviationstandards.org)</td></tr>
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<tr><td>Stakeholder</td><td colspan="2">State Civil Aviation Authorities, Aircraft Operators, Air Navigation Service Providers, Aerodrome Operators and Aerospace Industry</td></tr>
<tr><td>Runway Safety Priority</td><td colspan="2">Runway Excursions, Runway Incursions</td></tr>
<tr><td rowspan="4">Actions</td><td>Action</td><td>Related Contributing Factor (if applicable)</td></tr>
<tr><td>1. Ensure all infrastructure, radiotelephony phraseology, practices and procedures relating to runway operations are in compliance with ICAO, Regional and State provisions.

2. Ensure that information is continuously collected on all runway incidents/accidents.

3. Perform regular analysis and risk assessments to identify risks and contributing factors.

4. Develop, maintain and implement action plans to mitigate identified risks.

5. Monitor the implementation/effectiveness of action plans.

6. Actively participate in aerodrome local runway safety team (RST) activities. Not applicable to Aerospace Industry.

7. Ensure the appropriate protection of information.

8. Establish and maintain a ’just-culture’ reporting environment.</td><td>Latent Conditions
Regulatory Oversight</td></tr>
<tr><td>9. Implement Safety Management principles in accordance with the applicable ICAO provisions.

10. Make use of available resources such as the ICAO Safety Management Implementation Website and its safety management tools.

11. Ensure appropriate Safety Management training of staff and make use of available training such as the ICAO Safety Management Training Programme (SMTP).</td><td>Latent Conditions
Safety Management</td></tr>
<tr><td>12. Ensure runway safety training (e.g. runway excursion/incursion prevention) is part of initial and recurrent/refresher training regimes for all relevant operational staff.

13. Encourage joint training/awareness sessions between different stakeholders groups (e.g. pilots and controllers).</td><td>Latent Conditions
Training</td></tr>
<tr><td>References</td><td colspan="2">ICAO Annex 14 Vol I - Aerodromes

ICAO Annex 19 – Safety Management

ICAO PANS-Aerodromes (Doc 9981)

ICAO Safety Management Manual (Doc 9859)

ICAO Runway Safety Team Handbook Second Edition</td></tr>
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	Runway Safety IKit (www.icao.int/safety/RunwaySafety) ICAO Safety Management Implementation website (www.icao.int/safety/SafetyManagement/Pages/Examples-and-best-practices.aspx) SKYbrary – Runway Excursion and Runway Incursion Portals (www.skybrary.aero) The CAST/ICAO Common Taxonomy Team Website (www.intlaviationstandards.org) ACI Runway Safety Handbook – Second Edition, 2022 ACI Safety Management Systems Handbook – First Edition, 2016 European Action Plan for the Prevention of Runway Incursions V3.0 (November 2017) FSF: Global Action Plan for the Prevention of Runway Excursions (GAPPRE)

Stakeholder	**State Civil Aviation Authorities**	
Runway Safety Priority	**Runway Excursions**	
Actions	**Action**	**Related Contributing Factor (if applicable)**
	1. Ensure that runway safety is included in regulatory safety oversight activities. 2. Ensure the SSP includes concepts, actions and activities for the prevention of runway excursions. 3. Seek support from RSOO or other competent organisation, if needed. 4. Actively engage in and support RASG activities related to runway safety. 5. Certify aerodromes used for international operations in accordance with Annex 14 Vol I. 6. Actively engage in RASG safety risk management activities related to runway safety.	**Latent conditions** Regulatory Oversight
	7. Work with aircraft operators to improve adherence to SOPs. 8. Include requirements addressing flight crew use of the most suitable or appropriate level of automation during approach, landing and go-around in recurrent training.	**Latent Conditions** Flight Ops: SOPs Flight Ops: Training
	9. Establish requirements for operators to define and apply: a. Threat and Error Management (TEM) strategies for flight crew to prevent runway excursions, and SOPs, in accordance with regulations and manufacturers' guidance on take-off, landings and go-around, ensuring these incorporated into training. b. Policies and training that clearly define actions for Pilot Flying (PF) and Pilot Monitoring (PM), including interventions by PM.	**Undesired Aircraft States** Unstable Approach Long/floated landing
	14. Ensure effective implementation of the ICAO GRF in accordance with ICAO Annex 14 Vol I.	**Threats** Contaminated runway/taxiway Meteorology
References	ICAO Annex 1 – Personnel Licensing ICAO Annex 14 Vol I - Aerodromes ICAO PANS-Aerodrome (Doc 9981) ICAO Manual on Certification of Aerodromes (Doc 9774) Final Report to FSF: Go-Around Decision-Making and Execution Project	

	IATA/IFALPA/IFATCA/CANSO Unstable Approaches Risk Mitigation Policies, Procedures and Best Practices FSF: Global Action Plan for the Prevention of Runway Excursions (GAPPRE) EASA: European Plan for Aviation Safety (EPAS) 2017-2021 Runway Safety IKit (www.icao.int/safety/RunwaySafety) SKYbrary – Runway Excursion Portal (www.skybrary.aero) ICAO Circular 355 (Assessment, Measurement and Reporting of Runway Surface Conditions)

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<tr><td>Stakeholder</td><td colspan="2">State Civil Aviation Authorities</td></tr>
<tr><td>Runway Safety Priority</td><td colspan="2">Runway Incursions</td></tr>
<tr><td rowspan="3">Actions</td><td>Action</td><td>Related Contributing Factor (if applicable)</td></tr>
<tr><td>1. Ensure that runway safety is included in regulatory safety oversight activities.
2. Ensure the SSP includes concepts, actions and activities for the prevention of runway incursions.
3. Seek support from RSOO or other competent organisation, if needed.
4. Actively engage in and support RASG activities related to runway safety.
5. Ensure the effectiveness of airport runway safety teams (RSTs).</td><td>Latent conditions
Regulatory Oversight</td></tr>
<tr><td>6. Ensure that the content of training materials for Pilots, Air Traffic Controllers and Airside Vehicle Drivers includes runway incursion awareness, risks and prevention measures.</td><td>Latent conditions
Training</td></tr>
<tr><td>References</td><td colspan="2">ICAO Annex 19 – Safety Management
ICAO Manual on the Prevention of Runway Incursions (Doc 9870)
ICAO PANS ATM (Doc 4444)
ICAO PANS Aerodromes (Doc 9981)
European Action Plan for the Prevention of Runway Incursions V3.0 (November 2017)
Runway Safety IKit (www.icao.int/safety/RunwaySafety)
SKYbrary – Runway Incursion Portal (www.skybrary.aero)</td></tr>
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Stakeholder	**Aircraft Operators**	
Runway Safety Priority	**Runway Excursions**	
Actions	**Action**	**Related Contributing Factor (if applicable)**
	1. Ensure flight crew complete Crew Resource Management (CRM) and Threat and Error Management (TEM) training addressing runway excursion prevention with emphasis on team decision making, effective monitoring and appropriate Pilot Monitoring (PM) intervention. 2. Actively contribute to flight safety information sharing programmes, regional and local safety groups/teams.	**General Action**
	3. Implement TEM strategies for flight crew to prevent runway excursions, and SOPs, in accordance with regulations and manufacturers' guidance on take-off, landings and go-around, ensuring these incorporated into training. 4. Implement policy and training that clearly define actions for Pilot Flying (PF) and Pilot Monitoring (PM), including interventions by PM.	**Latent Conditions** Flight Ops: SOPs Flight Ops: Training
	5. Through internal programs, such as Flight Data Monitoring (FDM), Line Operations Safety Audits (LOSA) and voluntary Airline Safety Reports (ASR), implement means to assess: • SOPs compliance and deficiencies • The application of CRM principles. 6. Work with manufacturers to improve SOPs based on operational experience and the results of assessments. 7. Adopt, as a minimum, the defined limits set by the Original Equipment Manufacturers (OEMs) for deviations from approach parameters.	

	8. Ensure rejected take off/landing policy defines all scenarios that may require the discontinuation of an approach or take off and train pilots to perform them when necessary. 9. Ensure TEM strategies and SOPs are included in training programs, taking advantage of methods such as competency-based training and assessment (CBTA) and Evidence-Based Training (EBT). Training may include, but not be limited to: a) Assessment and analysis of non-normal situations not covered by SOPs b) Awareness of the impact of approach deviations from SOPs c) Effective use of current and new technologies to determine landing distance in all weather conditions d) Planning and conducting approaches with appropriate contingency plans e) Preparing for a go-around in the event of deteriorations of weather conditions f) Bounced landings, which are specific to each type of aircraft type, following OEM guidance g) Scenarios based training to develop effective TEM to prevent runway excursion (e.g., contaminated runway, last minute change of runway, deterioration of weather conditions, etc.) h) TEM pre-departure and arrival briefings i) Effective determination of take-off and landing performance calculation and emphasis on the resulting runway safety margin j) Effective usage of the ICAO GRF.	
	10. Identify and implement means to ensure flight crew awareness of weather and airport surface conditions. 11. Implement a procedure to perform landing performance calculation considering any potential deterioration of forecast weather at the actual time of arrival.	**Threats** Meteorology Contaminated runway/taxiway
	12. Establish policies that require that flight crew be prepared to execute a go-around. 13. Support flight crew use of the most suitable or appropriate level of automation during approach, landing and go-around. 14. Use root-cause analysis of SOP non-compliance to improve SOPs.	**Active Human Performance** Failure to GOA after Destabilized Approach Manual Handling / Flight Controls SOP Adherence
	15. Establish, implement, and maintain an accident prevention and flight safety program, including a comprehensive Flight Data Monitoring (FDM) programme.	**Undesired Aircraft States** Unstable Approach

	16. Work with ANSPs to implement procedural changes to reduce the rate of un-stabilized approaches, particularly to runways identified as having higher risk.	Long/floated landing
	17. Equip aircraft with runway-overrun awareness and alerting systems, as appropriate.	
References	FSF Report: Go-Around Decision-Making and Execution Project FSF Report: Reducing the Risk of Runway Excursions IATA/IFALPA/IFATCA/CANSO Unstable Approaches Risk Mitigation Policies, Procedures and Best Practices FSF: Global Action Plan for the Prevention of Runway Excursions (GAPPRE) Runway Safety IKit (www.icao.int/safety/RunwaySafety) FAA Runway Excursions website (www.faa.gov/airports/runway_safety/excursion) IATA Guidance Material for Improving Flight Crew Monitoring (http://www.iata.org/whatwedo/ops-infra/training-licensing/Pages/index.aspx) IATA Runway Excursion Risk Reduction Toolkit (www.iata.org/iata/RERR-toolkit/main.html) SKYbrary - Runway Excursion Portal (www.skybrary.aero) EASA: European Plan for Aviation Safety (EPAS) 2022-2026	

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<tr><td>Stakeholder</td><td colspan="2">Aircraft Operators</td></tr>
<tr><td>Runway Safety Priority</td><td colspan="2">Runway Incursions</td></tr>
<tr><td rowspan="4">Actions</td><td>Action</td><td>Related Contributing Factor (if applicable)</td></tr>
<tr><td>1. Ensure flight crew complete Crew Resource Management (CRM) and Threat and Error Management (TEM) training addressing runway incursion prevention with emphasis on team decision making, effective monitoring and appropriate Pilot Monitoring (PM) intervention.
2. Actively contribute to flight safety information sharing programmes, regional and local safety groups/teams.</td><td>General Action</td></tr>
<tr><td>3. Implement TEM strategies for flight crew to prevent runway incursions, and SOPs, in accordance with regulations and manufacturers’ guidance, ensuring these incorporated into training.
4. Implement policy and training that clearly define actions for Pilot Flying (PF) and Pilot Monitoring (PM), including interventions by PM.
5. Provide training and assessment for flight crew regarding aerodrome signs, markings and lighting.
6. Ensure pilots are made aware of any safety significant airport information.</td><td>Latent conditions
Training
Procedures
Active Human Performance</td></tr>
<tr><td>7. Equip aircraft with technologies to assist in improving situational awareness especially during low-visibility operations, such as Improved Resolution Airport Moving Maps, Electronic Flight Bags, Enhanced Vision Systems and Head up Displays (HUD).</td><td>Threats
Meteorology
Active Human Performance</td></tr>
<tr><td>8. Assess and maintain a high standard of radiotelephony skill amongst flight crew, such as:
a) Ensure all communications associated with runway operations at international airports are in aviation English
b) Ensuring the use of standard phraseologies in accordance with applicable State regulations and ICAO provisions (e.g. ICAO Manual of Radiotelephony (Doc 9432)).
9. Ensure flight crew awareness of relevant aerodrome works (WIP).
10. Establish taxi procedures for flight crews to ensure:
a) airport taxi plate is visible during taxiing
b) the cross-check and confirmation of taxi routes (including runway and taxiway crossings, clearance limit)
c) An awareness of maneuvering area runway incursion ‘Hot Spots’</td><td>Active Human Performance</td></tr>
<tr><td>References</td><td colspan="2">ICAO Annex 10 – Aeronautical Telecommunications</td></tr>
</table>

	ICAO Manual on the Prevention of Runway Incursions (Doc 9870) ICAO Manual of Radiotelephony (Doc 9432) ICAO PANS Ops (Doc 8168) Runway Safety IKit (www.icao.int/safety/RunwaySafety) SKYbrary - Runway Incursion Portal (www.skybrary.aero) European Action Plan for the Prevention of Runway Incursions V3.0 (November 2017)

<table>
<tr><td>Stakeholder</td><td colspan="2">Air Navigation Service Providers</td></tr>
<tr><td>Runway Safety Priority</td><td colspan="2">Runway Excursions</td></tr>
<tr><td rowspan="4">Actions</td><td>Action</td><td>Related Contributing Factor (if applicable)</td></tr>
<tr><td>1. Ensure that runway safety is included in initial and refresher training for Air Traffic Control staff.</td><td>Latent conditions
Training

Procedures</td></tr>
<tr><td>2. Ensure the timely provision of essential information on aerodrome conditions and other safety significant information such as weather, wind and runway surface conditions to flight crew.</td><td>Threats
Contaminated runway/taxiway

Meteorology</td></tr>
<tr><td>3. Identify ATM-related risk factors that can contribute to unstable approaches (e.g. airspace design/approach, procedures, controller actions, training and instructions, weather etc.) and take appropriate mitigation actions.</td><td>Undesired Aircraft States
Unstable Approach</td></tr>
<tr><td>References</td><td colspan="2">ICAO Annex 11 – Air Traffic Services

ICAO PANS-ATM (Doc 4444)

FSF Report: Go-Around Decision-Making and Execution Project

FSF Report: Reducing the Risk of Runway Excursions

IATA/IFALPA/IFATCA/CANSO Unstable Approaches Risk Mitigation Policies, Procedures and Best Practices

FSF: Global Action Plan for the Prevention of Runway Excursions (GAPPRE)

EASA: European Plan for Aviation Safety (EPAS) 2017-2021

Runway Safety IKit (www.icao.int/safety/RunwaySafety)

FAA Runway Excursions website (www.faa.gov/airports/runway_safety/excursion)

SKYbrary – Runway Excursion Portal (www.skybrary.aero)</td></tr>
</table>

Stakeholder	**Air Navigation Service Providers**	
Runway Safety Priority	**Runway Incursions**	
Actions	**Action**	**Related Contributing Factor (if applicable)**
	1. Ensure that runway safety is included in initial and refresher training for Air Traffic Control staff. 2. Assess and where necessary improve procedures for air traffic controllers, applying best practices and guidance. Areas where procedures may be improved include, but are not limited to, the following: a) Procedures that assist to maintain good situational awareness for controllers, pilots and airside vehicle drivers b) Procedures for when an aircraft or airside vehicle becomes lost or uncertain of its position on the manoeuvring area c) Procedures for runway inspections d) Runway occupied/vacated procedures.	**Latent conditions** Training Procedures
	3. Make use of technologies (such as A-SMGCS, stop bars and ARIWS) to improve situational awareness and provide warnings of runway incursions to controllers, pilots and vehicle drivers.	**Active Human Performance** **Threats** Meteorology
	4. Enable controllers to maintain a 'heads up' visual observation of all parts of the manoeuvring area, as far as practicable, whilst taking into consideration the availability and use of technologies (e.g. A-SMGCS). 5. Review and if necessary, improve the use of controller memory aids to reduce the possibility of conflicting ATC clearances. 6. Assess and if necessary, improve air traffic controllers' operational radiotelephony communications. Targeted areas should include, but not be limited to: a) Ensuring the use of full aircraft or airside vehicle call signs for all runway operation communications b) Establish and follow procedures to avoid confusion due to same or similar call signs c) Ensuring the use of standard phraseologies in accordance with applicable State regulations and ICAO provisions (e.g. ICAO Manual of Radiotelephony (Doc 9432)) d) Monitoring and ensuring the proper use of the read back procedure.	**Active Human Performance** **Latent Conditions** Workplace Conditions
	7. Ensure all communications associated with runway operations at international airports are in aviation English.	

	8. Use a common frequency for runway operations (to increase situational awareness of pilots, drivers, ATCOs).	
	9. Ensure air traffic controllers are informed about aerodrome Work In Progress (WIP). 10. Ensure proper coordination and contingencies agreed with Aerodrome Operator during WIP. 11. Ensure that all air traffic controllers are aware of runway incursion 'Hot Spots' (including changes) and associated mitigations.	**Latent Conditions** Aerodrome Design **Active Human Performance** Communication Errors
References	ICAO Manual on the Prevention of Runway Incursions (Doc 9870) ICAO PANS ATM (Doc 4444) ICAO PANS Aerodromes (Doc 9981) European Action Plan for the Prevention of Runway Incursions V3.0 (November 2017) Runway Safety IKit (www.icao.int/safety/RunwaySafety) SKYbrary – Runway Incursion Portal (www.skybrary.aero)	

Stakeholder	**Aerodrome Operators**	
Runway Safety Priority	**Runway Excursions**	
Actions	**Action**	**Related Contributing Factor (if applicable)**
	1. Provide all runways with a Runway End Safety Area (RESA) as required by ICAO Annex 14 Vol I, or appropriate mitigations such as arresting systems for aircraft overruns. 2. Ensure that runway strips are graded in accordance with ICAO Annex 14 Vol 1. 3. Ensure that infrastructure restrictions such as changes to the published declared distances and runway length available are communicated in a timely and effective manner.	**General Actions**
	4. Establish and ensure the effectiveness, in collaboration with relevant stakeholders, of airport runway safety teams (RSTs). 5. Ensure proper interface between the airport RST and the airport's SMS. 6. Conduct runway safety awareness campaigns that focus on local issues.	**Latent Conditions** Regulatory Oversight Safety Management
	7. Continue to support the implementation of the Global Reporting Format (GRF) for assessing and reporting runway surface conditions, ensuring that: • Staff are trained • Runway conditions reported and promulgated in a timely manner. 8. Ensure that runways, runway strips, manoeuvring areas and their associated visual aids such as signs, marking, lighting, etc. conform with ICAO Annex 14 Vol I. 9. Ensure that paved runways meet or exceed friction characteristics set by the State. 10. Make use of any available technologies, such as wind shear warning systems, where appropriate.	**Threats** Contaminated runway/taxiway Meteorology
References	ICAO Annex 14 Vol I - Aerodromes ICAO PANS-Aerodromes (Doc 9981) ICAO Runway Safety Team Handbook Second Edition FSF Report: Reducing the Risk of Runway Excursions FSF: Global Action Plan for the Prevention of Runway Excursions (GAPPRE) EASA: European Plan for Aviation Safety (EPAS) 2021-2025	

	Runway Safety IKit (www.icao.int/safety/RunwaySafety) SKYbrary – Runway Excursion Portal (www.skybrary.aero) ACI Runway Safety Handbook – Second Edition, 2022 ACI Safety Management Systems Handbook – First Edition, 2016

Stakeholder	**Aerodrome Operator**	
Runway Safety Priority	**Runway Incursions**	
Actions	**Action**	**Related Contributing Factor (if applicable)**
	1. Through the RST, conduct safety risk assessments and identify mitigations associated with operational changes such as: a) Significant increases or decreases in traffic demand or complexity (both aircraft and vehicles) b) Operations during increasingly adverse weather conditions (such as lower visibility, higher winds, winter conditions etc.) c) Modifications to aerodrome layout (i.e. runways, taxiways, or aprons are brought into operation, closed or decommissioned). 2. Conduct local runway safety awareness campaigns. 3. Identify, Implement and periodically review leading and lagging safety performance indicators.	**Latent conditions** Regulatory Oversight Safety Management
	4. Establish and implement a formal "maneuvering area driver training and assessment programme" and periodically review driver guidelines, with a focus upon: a) Improving requirements and training for driving in adverse weather conditions (in particularly low visibility) and driving at night b) Reviewing airside vehicle driver training programmes against available best practices and guidelines c) Ensuring that procedures for the control of all vehicles on the maneuvering area are developed and implemented in coordination with air traffic control. 5. Ensure effective and coordinated procedures for the activation and deactivation of Low Visibility Procedures (LVP) are in place.	**Active Human Performance** **Threats** Meteorology
	6. Through the RST, identify and periodically review local runway incursion "Hot Spots" using reports, investigation and other suitable data, taking actions to: a) Publish charts showing hot spots and ensure they are checked regularly for accuracy, revised as needed, distributed locally, and published in the AIP b) Employ suitable strategies to remove or mitigate hazards associated with identified "Hot Spots" at the earliest opportunity. 7. In coordination with ATC, consider implementing available technologies such as A-SMGCS and ARIWS.	**Aerodrome Design** **Active Human Performance**

	8. Ensure that new or changed infrastructure take runway incursion risks and their mitigations into consideration. Make use of available best practices and guidance materials. 9. Ensure that any planned WIP undergoes a safety assessment by the aerodrome RST and SMS to identify risks and establish mitigation actions. 10. Ensure all relevant stakeholders (ANSPs, Operators etc.) informed of WIP, in advance. 11. Coordinate and communicate the WIP of risk analysis with relevant stakeholders. 12. Ensure that any signs that may cause confusion during WIP in progress are correctly concealed.	
References	ICAO Annex 14 Vol I – Aerodromes ICAO Aerodrome Design Manual (Doc 9157) ICAO PANS Aerodromes (Doc 9981) ICAO Manual on the Prevention of Runway Incursions (Doc 9870) ICAO Runway Safety Team Handbook Second Edition European Action Plan for the Prevention of Runway Incursions (EAPPRI) V 3.0 Runway Safety IKit (www.icao.int/safety/RunwaySafety) SKYbrary – Runway Incursion Portal (www.skybrary.aero) ACI Runway Safety Handbook – Second Edition, 2022 ACI Safety Management Systems Handbook – First Edition, 2016	

Stakeholder	**Aerospace Industry**	
Runway Safety Priority	**Runway Excursions**	
Actions	**Action**	**Related Contributing Factor (if applicable)**
	1. Aircraft manufacturers should: a) Continue to monitor and analyse all runway excursions worldwide for the aircraft they produce b) Share lessons learned with operators and other stakeholders.	**General Actions**
	2. Support continued development of on-board real time monitoring and alerting systems to reduce the risk of overrun and veer-off during landing.	
	3. Aircraft manufacturers should continue to work with operators to: a) Improve SOP guidance based on operational experience b) Provide training resources for the effective application of SOP, technology and concepts to address risks.	**Latent Conditions** Flight Ops: SOPs Flight Ops: Training
	4. Continue to develop and improve the capabilities of stable approach and energy management monitoring and alerting systems.	**Active Human Performance** Failure to Go-Around after Destabilized Approach Manual Handling / Flight Controls
	5. Aircraft manufacturers should continue to provide SOP guidance with clear guidance and actions to be taken following an approach deviation.	
References	FSF Report: Go-Around Decision-Making and Execution Project FSF Report: Reducing the Risk of Runway Excursions IATA/IFALPA/IFATCA/CANSO Unstable Approaches Risk Mitigation Policies, Procedures and Best Practices FSF: Global Action Plan for the Prevention of Runway Excursions (GAPPRE) EASA: European Plan for Aviation Safety (EPAS) 2017-2021 Runway Safety IKit (www.icao.int/safety/RunwaySafety) SKYbrary – Runway Excursion Portal (www.skybrary.aero)	

Stakeholder	**Aerospace Industry**	
Runway Safety Priority	**Runway Incursions**	
Actions	**Action**	**Related Contributing Factor (if applicable)**
	1. Continue to develop/improve pilot visual aid enhancement technologies such as improved resolution airport moving maps, enhanced vision systems and Head up Displays (HUD).	**Threats** Meteorology
	2. Continue the development of runway collision avoidance systems using aircraft and airside vehicle positional data (both airborne and ground systems).	**Active Human Performance**
References	European Action Plan for the Prevention of Runway Incursions V3.0 (November 2017) EASA: European Plan for Aviation Safety (EPAS) 2017-2021 Runway Safety IKit (www.icao.int/safety/RunwaySafety) SKYbrary – Runway Incursion Portal (www.skybrary.aero)	

Appendix 1 – Current ICAO Runway Safety Accident Category Definitions (As per CICTT Aviation Occurrence Categories)

Category	Description
Abnormal Runway Contact (ARC)	Any landing or take-off involving abnormal runway or landing surface contact.
Ground Handling (RAMP)	Occurrences during (or as a result of) ground handling operations.
Runway Excursion (RE)	An event in which an aircraft veers off or overruns off the runway surface during either take-off or landing.
Runway Incursion (RI)	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.
Loss of Control on the Ground (LOC-G)	Loss of aircraft control while the aircraft is on the ground.
Collision with Obstacle(s) (CTOL)	Collision with obstacle(s), during take-off or landing whilst airborne.
Undershoot / Overshoot (USOS)	A touchdown off the runway surface.

CICTT Aviation Occurrence Categories may be found at www.intlaviationstandards.org

Appendix 2 – Runway Safety Related Accident and Serious Incident Statistics

The Runway Safety Programme's Runway Safety Action Plan Working Group (RSAP-WG) conducted a review of available accident and serious incident data and conducted a risk assessment in order to identify runway safety priorities and to prioritize runway safety improvement initiatives.

The RSAP-WG reviewed air transport accident and serious incident data from 2008 to 2016 for aircraft with a maximum take-off weight (MTOW) greater than 5700 kg. The following ICAO accident occurrence categories were included in the review and analysis:

- Abnormal Runway Contact
- Bird Strike
- Ground Collision
- Ground Handling
- Runway Excursion
- Runway Incursion
- Loss of Control on the Ground
- Collision with Obstacle(s)
- Undershoot / Overshoot
- Aerodrome

Figure 1 below shows the trend of runway safety accidents and serious incidents for the period 2008-2016 while Figure 2 shows the number of fatal accidents within that same period. The number of runway safety related accidents remains high, although the majority of the accidents are survivable with only 4 per cent of reported occurrences resulting in a fatal accident.

Figure 1: Total Runway Safety Accidents / Serious Incidents 2008-2016 (ICAO ADREP Data)

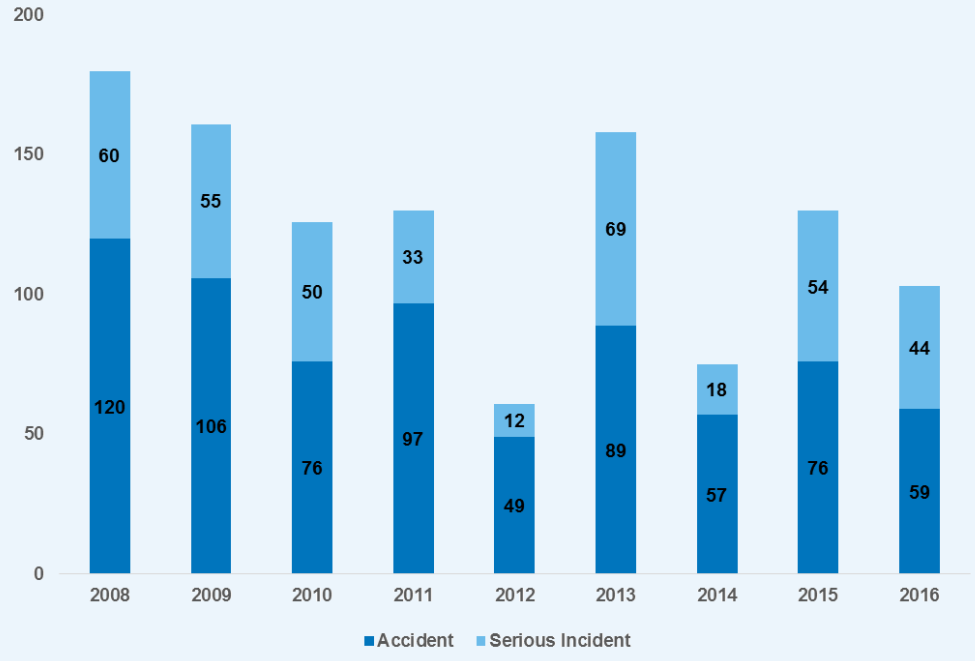


Figure 2: Number of runway safety fatal accidents per year 2008-2016 (ICAO ADREP Data)

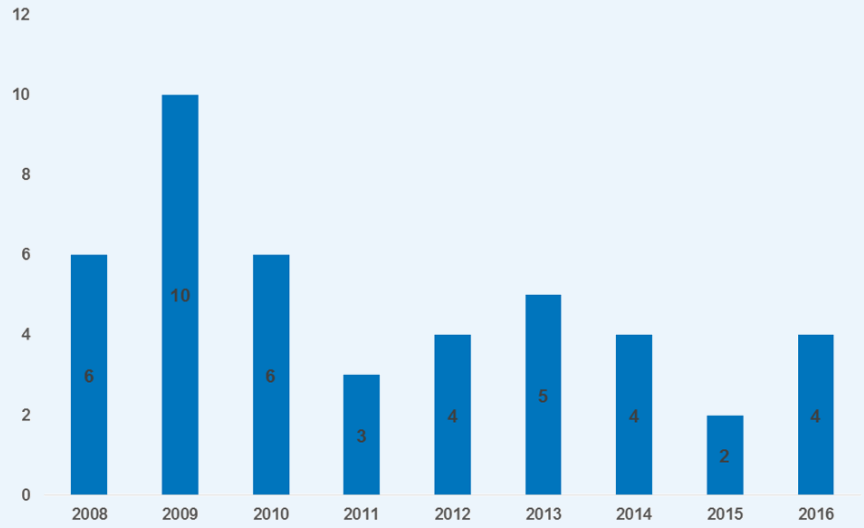
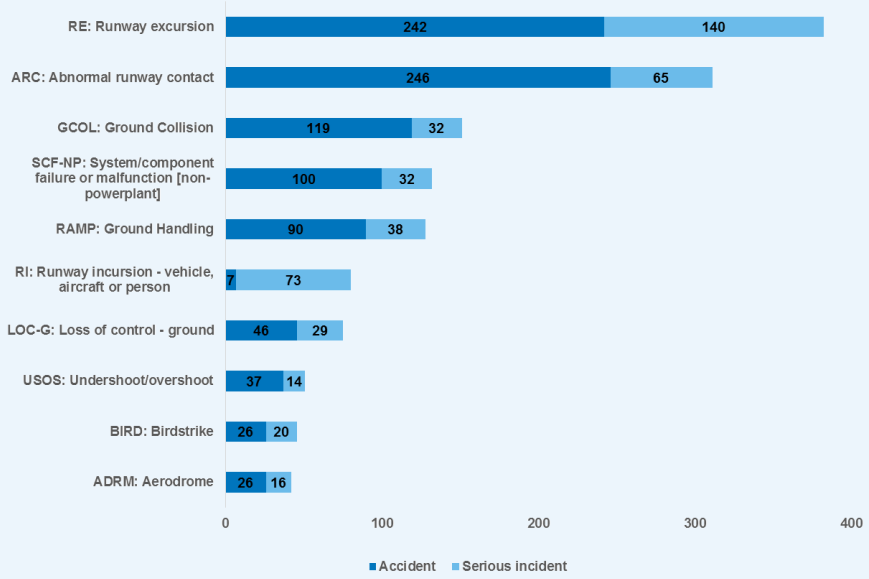


Figure 3 below shows the breakdown of runway safety accidents and serious incidents by occurrence category. Runway excursion was the top category with 34 per cent of reports. The next two highest occurrence categories reported were abnormal runway contact and ground collision, with 28 per cent and 14 per cent of reports respectively. The top three categories accounted for 76 per cent of the runway safety accidents and serious incidents during the reporting period.

Figure 3: Runway Safety Accidents / Serious Incidents by Occurrence Category 2008-2016 (ICAO ADREP Data)



Data analysis during the 2022 review of the action pan confirmed the on-going risks associated with runway excursions, as illustrated through figures 4 and 5.

Figure 4: 2020 High Risk Category Accident Overview (ICAO ADREP Data)

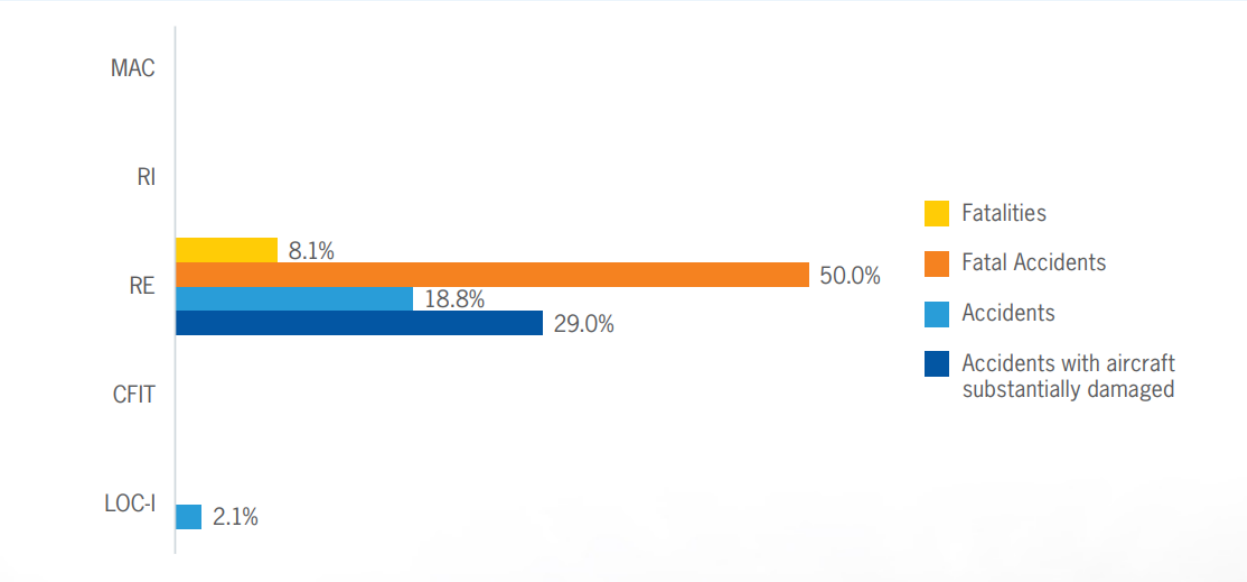
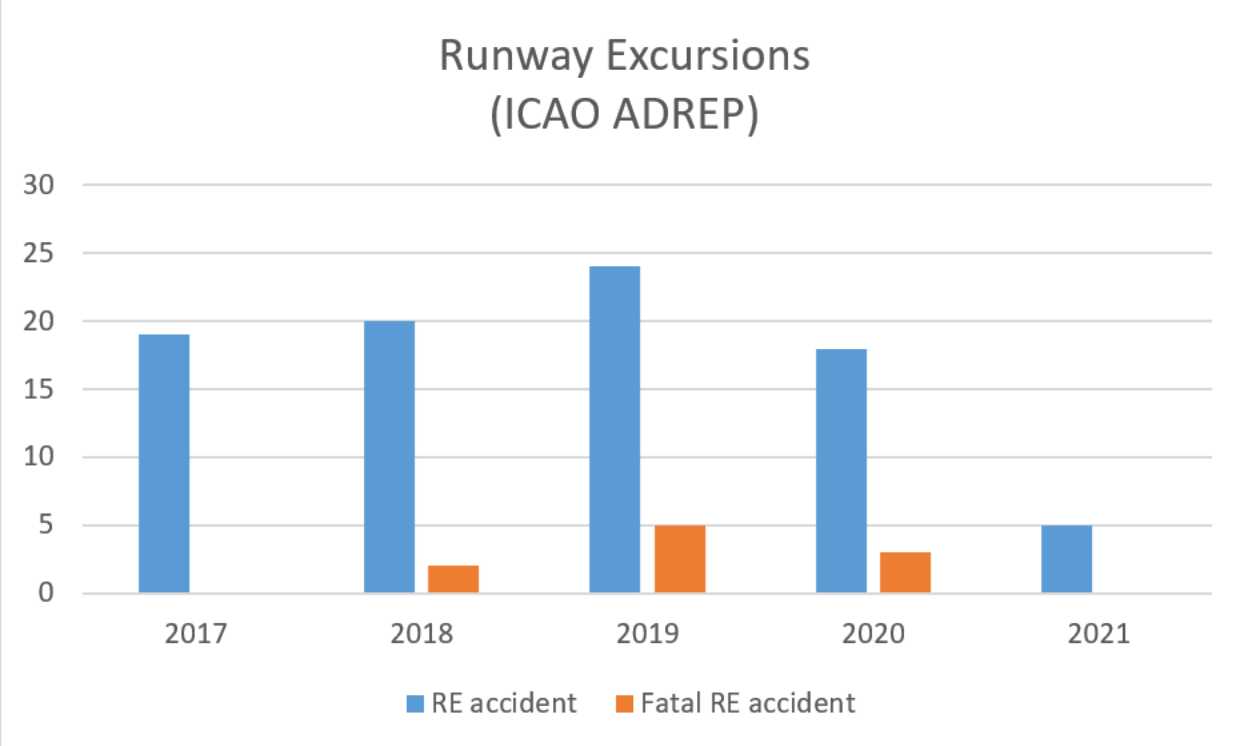


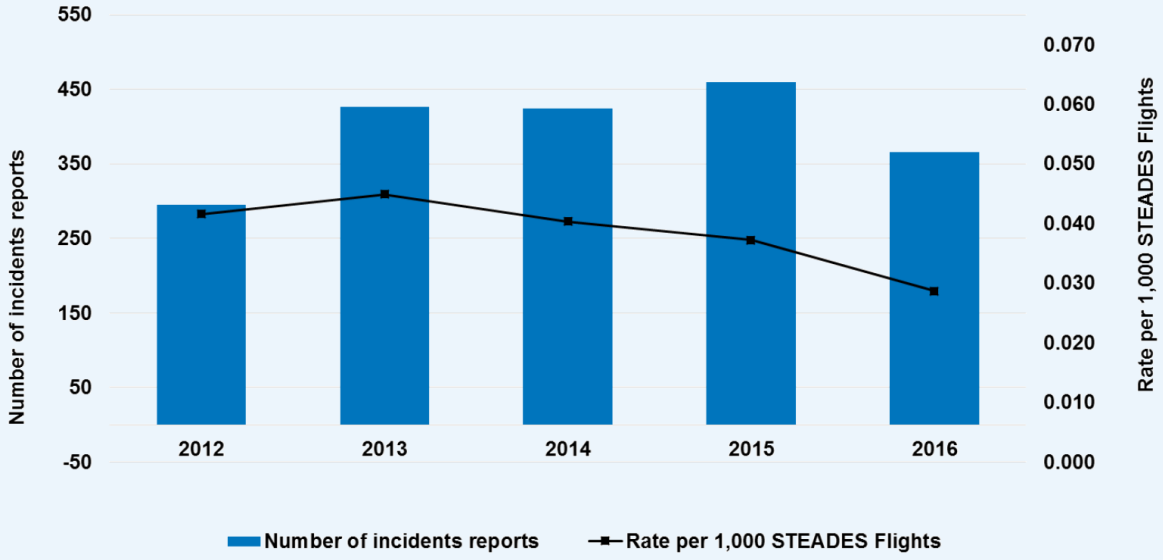
Figure 5: Number of Runway Excursions 2017-2021 (ICAO ADREP Data)



Runway Incursions

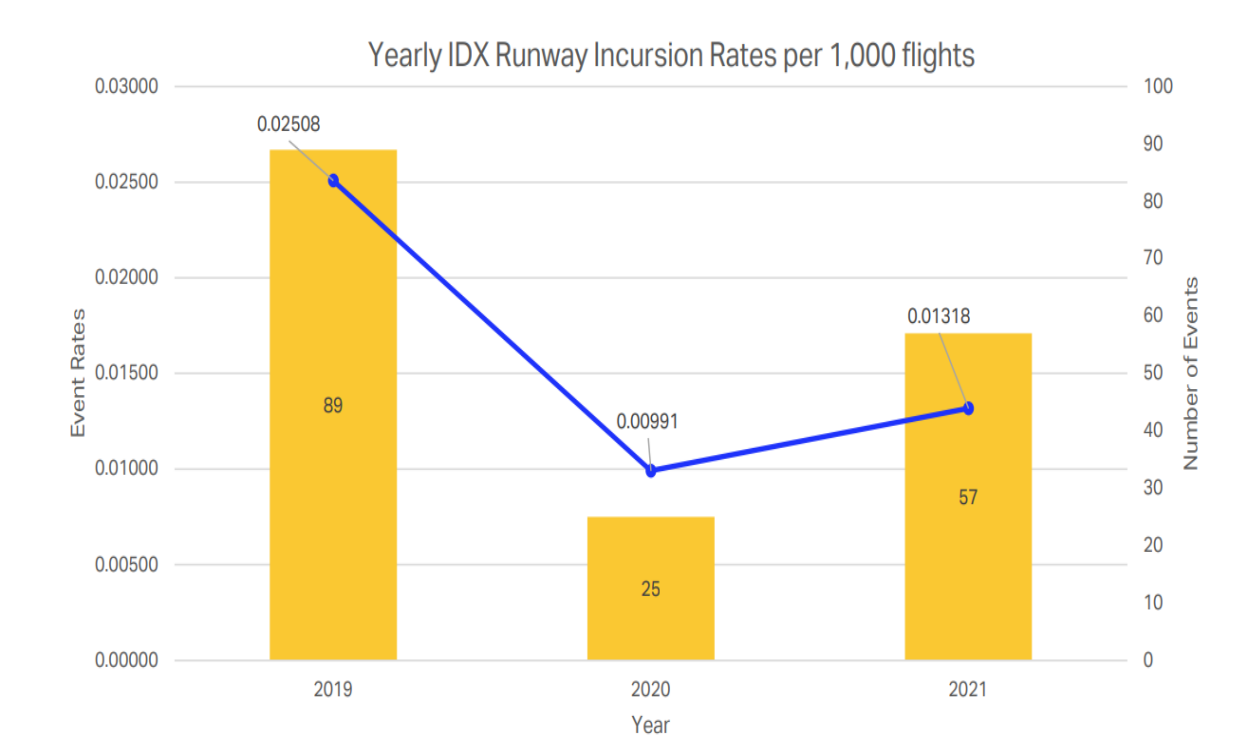
Although the runway incursion accidents reported between the period of 2008 to 2016 is very low, the number of runway incursion incidents remains high. An analysis by IATA of runway incursion incidents reported in their STEADES database shows that on average there is a runway incursion event reported in STEADES every day, with a total of 1,971 reports from 2012-2016. Figure 6 below shows the yearly distribution of runway incursion reported incidents from 2012 to 2016.

Figure 6: Runway incursion incidents yearly distribution 2012-2016 (IATA STEADES)



An expert review of available runway incursion data by RSP partners in early 2022 confirmed the on-going validity of the above analysis of 2012 to 2016 data, including the occurrence of approximately one runway incursion per day. The validity is further reinforced through the most recent data from IATA's Global Aviation Data Management Program's Incident Data Exchange (IDX). IDX is a web-based tool intended to provide participants with a comparative overview to highlight areas of flight safety concern (Figure 7).

Figure 7: Runway incursion rates per 1000 flights 2019-2021 (IATA IDX)



Runway Safety Risk Index for US airports

The Surface Safety Metric (SSM) is an indexing tool developed by the FAA to assess the risk of surface operations at U.S. airports. It is utilized to evaluate surface safety trends and the success or deficiency of mitigations.

The SSM uses a severity weighting system designed through modelling and 20 years' worth of NTSB data, assigning a weight to the outcome of an accident or incident. The weights are based on proximities to fatalities and/or damage, allocating credit for saving lives and minimizing damage.

Figure 8 below shows the normalized cumulative weighted index and the number of accidents and incidents since 2016. Table 1 shows the total risk weight per runway accident and incident category.

Figure 8: FAA Total runway safety events (accidents/incidents) and cumulative risk weighted index, 2016-2022 (SSM Data)

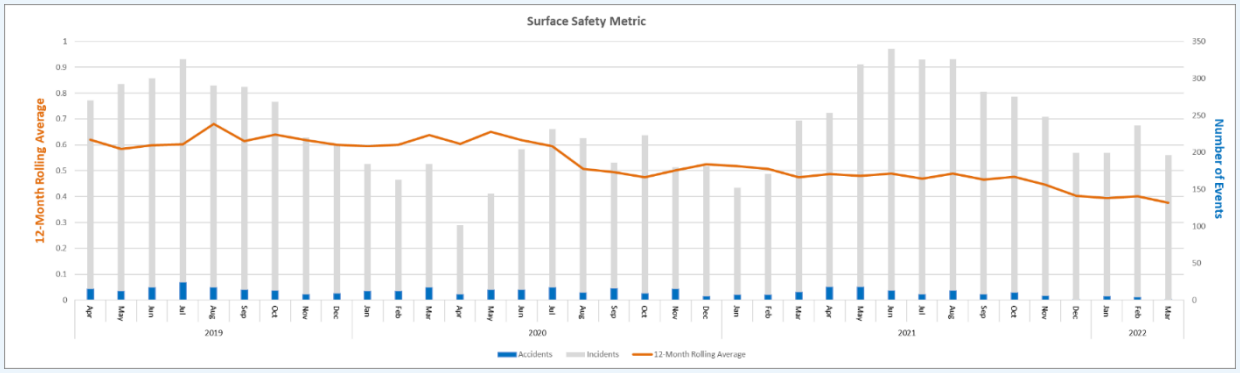


Table 1: FAA Risk severity weighting per surface accident/incident type.

Accident Type	Severity (Scaled)
Fatal Injury	1.00000
Serious Injury	0.41807
Minor Injury	0.25432
Destroyed Damage	0.24845
Substantial Damage	0.13328
Minor Damage	0.13153
Runway Collision	0.07129
Runway Excursion	0.06239
Taxiway Collision	0.06193
Incident Type	**Severity (Scaled)**
CAT A Runway Incursion	0.00648
CAT B Runway Incursion	0.00570

CAT C Runway Incursion	0.00151
CAT D Runway Incursion	0.00073
Runway Excursion	0.00567
Surface Incident	0.00128

Appendix 3 – References

- ACI Runway Safety Handbook – Second Edition, 2022
- ACI Safety Management Systems Handbook – First Edition, 2016
- EASA European Plan for Aviation Safety (EPAS) 2017-2021
- EUROCONTROL Study: Runway Incursion Incidents in Europe - Safety Functions Maps analysis of 2013 - 2015 data sample
- EUROCONTROL Study: Runway Incursion Serious Incidents & Accidents - SAFMAP analysis of 2006 - 2016 data sample
- European Action Plan for the Prevention of Runway Excursions Edition 1.0
- European Action Plan for the Prevention of Runway Incursions V3.0 (November 2017)
- FAA National Runway Safety Plan 2015-2017
- FAA Runway Incursion Safety Issue - Safety Risk Management Document
- FAA Runway Safety Metric Weighting Scheme
- FAA Runway Safety Report 2013-2014
- Flight Safety Foundation's Go-Around Decision-Making and Execution Project – March 2017
- Flight Safety Foundation's report on Reducing the Risk of Runway Excursions – May 2009
- Flight Safety Foundation and EUROCONTROL Global Action Plan for the Prevention of Runway Excursions (GAPPRE)
- IATA/IFALPA/IFATCA/CANSO Unstable Approaches Risk Mitigation Policies, Procedures and Best Practices
- IATA Annual Safety Report – 2016, Addendum A: Top Contributing Factors – Section 4
- ICAO Annex 1 – Personnel Licensing
- ICAO Annex 14 – Aerodromes
- ICAO Annex 19 – Safety Management
- ICAO Global Aviation Safety Plan 2017 – 2019 (Doc 10004)
- ICAO Manual on the Prevention of Runway Incursions (Doc 9870)
- ICAO PANS-Aerodromes (Doc 9981)
- ICAO Circular 355 - Assessment, Measurement and Reporting of Runway Surface Conditions
- ICAO Safety Management Manual (Doc 9859)
- ICAO Runway Safety Team Handbook Edition 2.0
- ICAO Safety Report 2017 and 2020 Editions