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# Global Action Plan for the Prevention of Runway Excursions

## Part 1 - Recommendations



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## STATEMENT OF COMMITMENT

Notwithstanding the specifics to the aviation risks in 2020 brought by the COVID-19 situation, the rate and numbers of runway excursions in the world remain steady in the last decade. Data shows the industry has been effective in reducing the rate of commercial flight's runway excursion accidents, but the absolute number of accidents and incidents and their severity still indicates a very high risk.

In a study of incident and accident data dedicated to this action plan process, IATA reported that between 2005 and the first half of 2019 23% (283) of accidents in the IATA's global accident database involved a runway excursion. This was the most frequent end state, followed by Gear-up landing/Gear collapse (15%) and Ground Damage (12%).

Managing the runway excursion risk is one of the best examples of how different aviation segments cannot do it alone. Runway excursion risk and resilience management relies on a system of tightly coupled factors for success dependent on a joint and coordinated effort of all the aviation players. The complexity of the runway excursion prevention comes also from the fact that the effect of the risk and resilience factors is highly cumulative – runway condition maintenance and reporting, aircraft performance and operations, collaborative approach path management and adherence to robust policies for safe descent and approach planning, stabilised approach, safe landing and go-around are some examples.

The jointly owned risk requires joint solutions. This is why the industry came together, within a dedicated working group, to discuss and agree on what are the most important actions to address the runway excursion risk. The result is a list of recommendations that represent the industry consensus on what are the best practices and intervention beyond simple regulatory compliance. The recommendations are mainly generic and it will be for the responsible organisations to decide specific details for possible implementation, after taking local conditions and specific context into account.

Addressing both the risk and the resilience factors has been a guiding principle of the working group that reviewed accident and incident data, single scenarios and best practices, and suggestions on risk and resilience management.

The recommendations are the result of the combined and sustained efforts of organisations representing all segments of aviation. 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, Aircraft Manufacturers, R&D organisations, Regulators, International Organisations and Associations.

# INTRODUCTION AND BACKGROUND

This document is Volume I of the Global Action Plan for the Prevention of Runway Excursions (GAPPRE). Volume I contains the agreed recommendations to the following civil aviation organisations: Aerodrome Operators, Air Navigation Service Providers, Aircraft Operators, Aircraft Manufacturers, Regulators, ICAO and addressees of the R&D recommendations (States, international organisations and the Industry).

Volume II of GAPPRE will provide explanatory and guidance material, and related best practices for the recommendations listed further in this document.

The development of the GAPPRE recommendations is based on the following principles:

- Provide recommendations that address actions beyond regulatory compliance – the recommendations in this action plan are not exhaustive in managing the runway excursion risk and resilience. It is fundamental that organisations shall be compliant to international, regional and national rules and regulations.
- Recommendations based on consensus – a recommendation is included in the action plan only if there was a consensus for it during the drafting and the subsequent validation process.
- Embrace further data analytics – suggest to actors to make better use of existing data and fuse and analyse larger volumes of heterogeneous data.
- Address both longitudinal and lateral runway excursions.
- Include runway excursion mitigations.
- Promote technology embedded in systemic solutions – promote technological solutions but clearly integrated with the respective training, procedures, standardisation, certification and oversight.
- Provide R & D recommendations for issues with clear potential high-risk mitigation benefits but without maturity for implementation within 10 years horizon.
- Promote a set of selected proven efficient solutions, which are not yet «standard» (still not used by all actors) but that have been proven to be efficient in reducing the risk of runway excursions, based on data analysis and lessons learnt.
- Provide functional recommendations – leave the design of specific implementation solution to the industry.
- The verb “Should” is used 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 implementation.

The organisations, which this action plan is addressed to, should:

- Organise a review of the respective recommendations and assess their relevance against their local conditions and specific context.
- Consult the best practices for implementing the selected recommendations and seek support, if needed, from the GAPPRE coordinating partners.
- Conduct an appropriate impact assessment (including safety assessment) when deciding on the specific action to implement the recommendations.
- Implement the specific action / change and monitor its effectiveness.
- Share the lessons learnt with the industry.





# GLOBAL ACTION PLAN FOR THE PREVENTION OF RUNWAY EXCURSIONS

## RECOMMENDATIONS

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## RECOMMENDATIONS TO AERODROME OPERATORS

REF	Recommendation	Action by	Implementation Date
<b>ADR1</b>	Ensure that runways are constructed, resurfaced and repaired in accordance with the national or regional (e.g. EASA) regulations, so that effective friction levels and drainage are achieved.	Aerodrome Operator.	<b>Ongoing</b>
<b>ADR2</b>	An appropriate program should be effectively implemented to ensure the removal of contaminants from the runway surface as rapidly and completely as possible to minimize accumulation and preserve friction characteristics.	Aerodrome Operator.	<b>End of 2023</b>
<b>ADR3</b>	If provided, ensure that approach radio navigation aids (e.g. ILS) and visual aids (e.g. AGL, PAPIs and surface markings) are maintained in accordance with ICAO Standards and Recommended Practices.  An appropriate method for the inspection and assessment of markings deterioration should be implemented.	Aerodrome Operator.	<b>End of 2023</b>
<b>ADR4</b>	Ensure that the runway holding positions are clearly marked, signed and if required, lit. If intersection take-offs are conducted, install at the relevant runway holding positions signs to indicate the Take-Off Run Available (TORA).	Aerodrome Operator.	<b>End of 2023</b>
<b>ADR5</b>	Ensure robust procedures are in place for calculating temporary reduced declared distances e.g. due to work in progress on the runway. When reduced declared distances are in operation, ensure that the temporary markings, lighting and signs accurately portray the reduced distances and that they are well communicated in a timely manner to the state's aeronautical information services for publication and to the relevant ATS units.	Aerodrome Operator.	<b>End of 2023</b>
<b>ADR6</b>	Ensure that the procedures to assess runway surface conditions according to ICAO Global Reporting Format include reactive as well as proactive surface assessment to make sure hazardous changes are all identified and communicated in a timely manner.	Aerodrome Operator.	<b>End of 2021</b>
<b>ADR7</b>	Ensure robust procedures are in place for communicating information regarding changing surface conditions as frequently as practicable to the appropriate services according to the ICAO Global Reporting Format. Roles, responsibilities of stakeholders and coordination procedures should be formalised.	Aerodrome Operator.	<b>End of 2021</b>
<b>ADR8</b>	In accordance with ICAO standards (and regional, e.g. EASA regulations), wind sensors and wind direction indicators (wind socks) should be sited to give the best practicable indication of conditions along the runway and touchdown zones.	Aerodrome Operator.	<b>End of 2025</b>
<b>ADR9</b>	Consider equipping for digital transmission of ATIS as appropriate to ensure that ATIS information is updated in a timely manner.	Aerodrome Operator.	<b>End of 2025</b>

REF	Recommendation	Action by	Implementation Date
<b>ADR10</b>	If installed, RWY centreline lights should also be used together with the runway edge lights whenever runway edge lights are switched on and when the runway is in use.	Aerodrome Operator.	<b>End of 2023</b>
<b>ADR11</b>	Ensure appropriate coordination with the meteorological service provider, the ANSP and the aircraft operators to regularly assess the relevancy of weather data, in particular at large aerodromes where there could be spatial differences in weather data.	Aerodrome Operator.	<b>End of 2023</b>
<b>ADR12</b>	Ensure runway exits are appropriately named according to a logic of succession of numbers and letters avoiding possible ambiguity.	Aerodrome Operator.	<b>End of 2025</b>
<b>ADR13</b>	Runway surroundings should be considered when designing or modifying strips or RESA. It is necessary to consider the local constraints against ICAO provisions and regional (e.g. EASA) regulations so as to ensure relevant mitigation.	Aerodrome Operator.	<b>Ongoing</b>
<b>ADR14</b>	Information related to air operations hazard or specificities in the airport vicinity should be identified and addressed to pilots in the Local Runway Safety Team (LRST) and published through an appropriate means.	Aerodrome Operator.	<b>End of 2023</b>
<b>ADR16</b>	Runway condition codes assessed should be compared against braking action reports by the pilots to ensure the accuracy of the information provided to the pilots.	Aerodrome Operator.	<b>End of 2023</b>
<b>ADR17</b>	Consider using Approach Path Management (APM) in coordination with local ATC and aircraft operators. Associated issues should be addressed by the LRST.	Aerodrome Operator.	<b>End of 2023</b>

## RECOMMENDATIONS TO AIR NAVIGATION SERVICE PROVIDERS

REF	Recommendation	Action by	Implementation Date
<b>ANSP1</b>	ANSPs should ensure the importance of stabilised approach, its elements and compliance with final approach procedures and aircraft energy management are included in initial and refresher training of ATCOs conducted by ANSPs and ATCO Training Organisations, as well as in AFISOs training, as applicable.	Air Navigation Service Provider.	<b>End of 2023</b>
<b>ANSP2</b>	<p>With regard to assignment of or change to runway assignment for arriving or departing traffic:</p> <p>ANSP2 a. Whenever the runway change is pre-planned, notify it as early as practicable together with the expected time of the change to flight crews, including by adding relevant information in ATIS, where available.</p> <p>ANSP2 b. As far as practicable, avoid changing the assigned runway to aircraft on approach or taxiing for departure.</p> <p>ANSP2 c. ANSPs should ensure ATCOs are aware that RWY changes create additional workload, increase vulnerability to error and flight crews need time to re-brief and prepare for it.</p> <p>ANSP2 d. ANSPs should ensure that the runway configuration change procedure/process takes account of the above points and of the tailwind information as appropriate.</p> <p>ANSP2.e. When operationally possible, accept the flight crew preference for a runway when requested “due to performance limitations”.</p>	Air Navigation Service Provider.	<b>End of 2023</b>
<b>ANSP3</b>	<p>ANSPs should:</p> <p>ANSP3 a. Review available data (e.g. occurrence reports, go-around / missed approach data etc.) with the aim of identifying the ANSP-related runway excursion contributing factors and relevant mitigations, for example enhanced airspace design and procedures and ATCO training and procedures.</p> <p>ANSP3 b. Share at network level the identified runway excursion contributing factors and relevant mitigations.</p>	Air Navigation Service Provider.	<b>End of 2023</b>
<b>ANSP4</b>	<p>Review processes covering the provision of essential information on aerodrome conditions such as weather, wind and runway surface conditions (e.g. when ‘wet’ or contaminated) to ensure:</p> <p>ANSP4 a. A consistent, timely and accurate broadcast of aerodrome information.</p> <p>ANSP4 b. The integrity of the essential information supply chain from the originator (e.g. Met Office/Aerodrome Operator) to the user (e.g. flight crews, ATS, Met Office, aerodrome operator and AIS provider).</p> <p>ANSP4 c. Training on the use of ATIS/D-ATIS is provided to relevant operational staff.</p> <p>3.3.4.d. Compliance with the ICAO Global Reporting Format for runway surface conditions assessment and reporting, including the training of the relevant ANSP personnel.</p>	Air Navigation Service Provider.	<b>End of 2021</b>

REF	Recommendation	Action by	Implementation Date
<b>ANSP5</b>	<p>ANSP5 a. ANSPs should ensure that flight crews are informed of the Take off Run Available (TORA) or the Landing Distance Available (LDA) if these differ from the published data using appropriate means. The information should include any alternative runways which may be available.</p> <p>ANSP5 b. ATS providers should collaborate with the aerodrome operators to determine the runway entries from which intersection take-offs may be performed, and develop coordinated procedures for such operations.</p>	Aerodrome Operator.	<b>End of 2023</b>
<b>ANSP6</b>	Participate in runway excursion safety information sharing at network level to facilitate, using just culture principles, the free exchange of relevant information on actual and potential safety deficiencies.	Air Navigation Service Provider.	<b>End of 2023</b>
<b>ANSP7</b>	If installed, RWY centreline lights should also be used together with the runway edge lights whenever runway edge lights are switched on and when the runway is in use.	Air Navigation Service Provider.	<b>End of 2023</b>
<b>ANSP8</b>	Consider equipping for digital transmission of ATIS, as appropriate (e.g. via telephone or other means).	Air Navigation Service Provider.	<b>End of 2025</b>

## RECOMMENDATIONS TO AIRCRAFT OPERATORS

REF	Recommendation	Action by	Implementation Date
<b>OPS1</b>	Aircraft operators should participate in safety information sharing networks with all relevant stakeholders. This should facilitate the free exchange of relevant runway safety information including identified risks, safety trends and good practices.	Aircraft Operator.	<b>Ongoing</b>
<b>OPS2</b>	Aircraft operators should include and monitor aircraft parameters related to potential runway excursions in their Flight Data Monitoring (FDM) programme.  Whenever standardised FDM markers are provided by the industry, aircraft operators should use them with priority to ensure the effectiveness of risk mitigation and safety assurance associated with runway excursion barriers and to allow comparability on an industry level.	Aircraft Operator.	<b>End of 2023</b>
<b>OPS3</b>	Aircraft operators and training providers should include realistic, evidence- and competency-based scenarios into their training programmes requiring threat and error management for runway excursion prevention during both take-off and landing.  This should include evidence- and competency-based recurrent simulator training programmes which are representative in terms of environmental conditions, including crosswind, landing on contaminated/slippery runways and poor visibility adapted with simulator representativeness.  Representativeness of simulators should be assessed and their limitations communicated (in order to avoid negative training)	Aircraft Operator.	<b>End of 2023</b>
<b>OPS4</b>	Aircraft operators should incorporate appropriate technical solutions to reduce runway excursion risks, where available (including Runway Overrun Awareness and Alerting System (ROAAS), and runway veer off awareness and alerting systems, when and if available). If technical solutions are not available, operators should implement appropriate SOPs and TEM strategies which support flight crews in effectively preventing runway excursions.	Aircraft Operator.	<b>End of 2027</b>
<b>OPS5</b>	If technically feasible, aircraft operators should equip their aircraft fleet with data-link systems (e.g. ACARS) enabling them to digitally obtain the latest weather information (e.g. D-ATIS or METAR). The use of this technical means has to be supported by adequate SOPs enabling all pilots on the flight deck to familiarise themselves with the latest weather conditions without impeding aircraft and flight path monitoring.	Aircraft Operator.	<b>End of 2025</b>
<b>OPS6</b>	Aircraft operators should implement policies for flight crews not to accept ATC procedures and clearances which have the potential to decrease safety margins to an unacceptable level for the flight crew thereby increasing the risk of runway excursions. This includes such procedures and clearances which increase the likelihood of having an unsafe approach path management with consequences for safe landing, e.g. which bear the risk of being un-stabilised at the landing gate or high-energy approaches.	Aircraft Operator.	<b>End of 2027</b>

REF	Recommendation	Action by	Implementation Date
	<p>These policies should be further supplemented by the implementation of effective SOPs and flight crew training.</p> <p>Flight Crews should be required to report such risks within their operators SMS and the aircraft operator should further report such risks to the ANSPs via established reporting systems. (see OPS1)</p>		
<b>OPS7</b>	<p>Aircraft operators should implement policies for safe descent and approach planning, stabilised approach, safe landing and go-around and should ensure that these are implemented in their training. Aircraft operators should define which elements of these policies have to be included and highlighted during the approach briefings by flight crews.</p>	Aircraft Operator.	<b>End of 2023</b>
<b>OPS8</b>	<p>Aircraft operators should implement policies or SOPs for flight crews not to conduct take-off or approach following any runway change until the appropriate set-up, planning, performance calculations (for multi-pilot operations this includes independent calculations and crosschecks by at least two pilots) and re-briefings are completed. When a take-off runway change is received whilst taxiing, the above should be performed by flight crew without rushing and when the aircraft is stationary.</p> <p>Runway-excursion related TEM should be addressed in the briefing every time a runway change is expected, probable or actually occurs.</p>	Aircraft Operator.	<b>End of 2023</b>
<b>OPS9</b>	<p>Aircraft operators should implement policies or SOPs for flight crews to request a more favourable runway for take-off or landing for any reason, which may affect the safety of the flight and to advise the safety reasons to ATC.</p>	Aircraft Operator.	<b>End of 2023</b>
<b>OPS10</b>	<p>Aircraft operators should implement policies or SOPs requiring flight crews to confirm prior to commencing the take-off or landing phase that the actual conditions (weather and aircraft configuration) are better or at least correspond to the values used for performance calculations. When conditions are predicted to approach operational limitations, flight crews should be required to identify the limiting parameters and incorporate this into their TEM briefing.</p>	Aircraft Operator.	<b>End of 2023</b>
<b>OPS11</b>	<p>Aircraft operators should define company cross- and tailwind limits which are specific to each type of aircraft operated. Moreover, specific guidance on the runway conditions and the gust components should be clarified.</p> <p>Aircraft operators should establish clear policies to allow their flight crews to reduce the established limits whenever deemed necessary for safety reasons in actual flight operation.</p>	Aircraft Operator.	<b>End of 2023</b>

REF	Recommendation	Action by	Implementation Date
<b>OPS12</b>	<p>Aircraft operators should publish specific guidance and training for their flight crews on crosswind take-off and landing techniques, especially in wet, slippery or contaminated runway conditions. This should include the correct touchdown and stopping techniques, which incorporate all available control and deceleration devices as well as TEM topics and methods for effective monitoring and intervention by the PM.</p> <p>Aircraft manufacturers advice should be incorporated, if available.</p>	Aircraft Operator.	<b>End of 2023</b>
<b>OPS13</b>	<p>OPS13 a. Aircraft operators should ensure their policies or SOPs require flight crews to perform independent performance calculations. This should also include independent cross-checks of the load and trim sheet and the actual TORA/TODA from the AIS (e.g. if reduced by NOTAM) with TORA/TODA used to calculate the take-off performance. This independent calculation should also be applied following a runway change.</p> <p>OPS13 b. Aircraft operators should ensure their policies or SOPs include flight crew gross-error checks and crew cross-checks prior to any data input and prior to executing any data input in the FMS.</p>	Aircraft Operator.	<b>End of 2023</b>
<b>OPS14</b>	<p>Aircraft operators should publish SOPs and guidance which incorporate runway excursion mitigation associated with rejected take-off decision making and rejected take-off manoeuvres.</p> <p>Appropriate training should be provided.</p>	Aircraft Operator.	<b>End of 2023</b>
<b>OPS15</b>	<p>Aircraft operators should develop SOPs which include an assessment, possibly prior to the top of descent, of landing performance based upon latest and best-available weather information. This calculation should not be performed using dispatch weather information. Flight crews should be informed of the type of landing distance data available (factored or unfactored) and of which correlating safety factors are used.</p> <p>When possible, the crew should complete descent, approach, landing planning, set-up and briefings prior to the top-of-descent.</p>	Aircraft Operator.	<b>End of 2023</b>
<b>OPS16</b>	<p>Aircraft operators should develop a clear go-around policy which should be further supplemented by a set of SOPs and guidance materials to put this policy into action. This go-around policy should enable every flight crew member on the flight deck to call for a go-around at any time unless an emergency situation dictates otherwise.</p> <p>In all cases, the SOPs should require both pilots to have and retain the required visual reference below DA/MDA with a go around call mandatory if either pilot loses it. A go-around should also be mandatory if the approach becomes un-stabilised below the specified approach/landing gate.</p> <p>Recurrent simulator training should be provided on the competencies of safe go-around in various stages during the approach and landing, including shortly prior or during touchdown (before activation of thrust reversers).</p>	Aircraft Operator.	<b>End of 2023</b>



REF	Recommendation	Action by	Implementation Date
<b>OPS17</b>	Aircraft operators should require the flight crew to carefully evaluate operational safety before selecting/accepting an approach and landing runway including the following: weather conditions (in particular cross and tailwind), runway condition (dry, wet or contaminated/slippery), inoperable equipment and aircraft and flight crew performance in order to reduce runway excursion risks.	Aircraft Operator.	<b>End of 2023</b>
<b>OPS18</b>	Aircraft operators should clearly define stabilised approach, landing and go-around polices in their operations manual. These polices have to be aligned with regulations requirements and manufacturers guidance. Supplementing SOPs should include the requirement for completion of the landing checklist and flying with the final approach speed latest at the defined approach/landing gate. These SOPs should include appropriate means for the pilot monitoring (PM) to effectively monitor and, if needed, intervene. To properly implement the defined policies and SOPs, aircraft operators have to deliver appropriate training.	Aircraft Operator.	<b>End of 2023</b>
<b>OPS19</b>	Aircraft operators should publish SOPs and guidance and provide training highlighting the importance of active monitoring and effective intervention by the pilot monitoring (PM) during descent, approach, approach path management and landing. Actions to be taken by the PM and required reactions by the PF should be clearly documented in the official publication (e.g. SOPs or Operations Manual, FCOM, etc). These publications should include guidance how to achieve effective PM performance, independent of rank and experience.	Aircraft Operator.	<b>End of 2023</b>
<b>OPS20</b>	Aircraft operators should publish SOPs and guidance for their pilots not to conduct auto-land approach manoeuvres at airports when low visibility procedures (LVP) are not in force, unless: - the ILS critical and sensitive areas are protected, - ATC had been informed and reassurance of ILS sensitive area protection had been received or - specific precautions have been taken and risk analysis has been performed. More information is available in the guidance material. or - the aircraft is demonstrated as robust to non-protection of ILS sensitive area.	Aircraft Operator.	<b>End of 2023</b>

REF	Recommendation	Action by	Implementation Date
<b>OPS21</b>	<p>Aircraft operators should clearly define their policy for a safe landing and publish it in their SOPs and Operations Manuals. This policy should clearly define acceptable touchdown limits and prohibit intentional long and short landings, e.g. to minimise runway occupancy or minimise taxi time to the gate. The supplementing SOPs and guidance should include means, methods and responsibilities with regard to how a crew will identify and act on such limits.</p> <p>Appropriate classroom and simulator training should be provided.</p>	Aircraft Operator.	<b>End of 2023</b>
<b>OPS22</b>	<p>Aircraft operators should publish SOPs and guidance for landing techniques that are aligned with ICAO Global Reporting Format and manufacturer's guidance for all runway states and environmental conditions.</p> <p>Aircraft operators should require their flight crew to always favour a go-around or diversion rather than to attempt a landing when approaching wet, slippery/contaminated runways without appropriate stopping margin and/or in limiting wind situations.</p> <p>Appropriate training should be provided including training in the ICAO Global Reporting Format.</p>	Aircraft Operator.	<b>End of 2021</b>
<b>OPS23</b>	<p>Aircraft operators should publish SOPs for their flight crews when runway conditions are uncertain or actual or anticipated slippery wet, slippery or contaminated, to fully use all deceleration means, including speed brakes, wheel braking and reverse thrust irrespective of noise-related restrictions, until a safe stop is assured, unless this causes controllability issues.</p>	Aircraft Operator.	<b>End of 2021</b>
<b>OPS24</b>	<p>Aircraft operators should publish SOPs and guidance and provide training highlighting the importance of active monitoring, including monitoring of the activation of the stopping devices on landing, and effective intervention during landing associated with pilot monitoring duties and performance.</p> <p>Appropriate training should be provided.</p>	Aircraft Operator.	<b>End of 2023</b>
<b>OPS25</b>	<p>Aircraft operators should define policies and procedures to address bounced landings. Whenever available, aircraft operators should take into account and include manufacturers' guidance. Moreover, aircraft specific and appropriate training, including simulator training, should be provided for flight crews.</p>	Aircraft Operator.	<b>End of 2023</b>
<b>OPS26</b>	<p>Aircraft operators should develop guidance on whether a change of control during landing roll out has to take place and require their flight crews to brief and agree on the planned runway exit, taking into account the friction status of both runway and runway exit, whenever available.</p> <p>When a change of control is necessary during roll-out, this should be performed below taxi speed and when the aircraft trajectory is stable.</p>	Aircraft Operator.	<b>End of 2023</b>

REF	Recommendation	Action by	Implementation Date
<b>OPS27</b>	Aircraft operators should implement policy, technical solutions or SOPs which confirm that the aircraft is lining up on the planned runway, its centreline and via the correct intersection.	Aircraft Operator.	<b>End of 2023</b>
<b>OPS28</b>	Aircraft operators should publish SOPs and guidance for their flight crew not to accept line-up, backtrack or take-off clearances until pre-take-off preparation (including cabin secure), procedures and checklists are completed to the appropriate point which permits the accomplishment of the associated manoeuvre without delay and until they have reported "ready for departure" to ATC.  Aircraft operators should publish an explicit SOP for "rolling take-offs".	Aircraft Operator.	<b>End of 2023</b>
<b>OPS29</b>	Aircraft operators should foster a culture that stimulates safe behaviour, which encourages risk-averse decision-making by flight crews.	Aircraft Operator.	<b>Ongoing</b>
<b>OPS30</b>	Aircraft operators should, when determining their TEM strategies and SOPs, identify runways with a remaining safety margin of less than 400m/1200ft after application of all required safety factors as safety critical.	Aircraft Operator.	<b>End of 2023</b>
<b>OPS31</b>	Aircraft operators should monitor go-around policy compliance through their FDM programmes and establish go-around safety performance indicators (SPIs) for monitoring through their SMS. In addition to monitoring go-arounds, aircraft operators should also monitor discontinued approaches.	Aircraft Operator.	<b>End of 2023</b>
<b>OPS32</b>	Aircraft operators should: 1) Define an unstable approach followed by landing as a mandatory reporting event by the flight crew and; 2) Minimise the need to report a go-around due to an unstable approach unless there is another significant event in relation to the go-around, e.g. flap overspeed.	Aircraft Operator.	<b>End of 2023</b>
<b>OPS33</b>	Aircraft operators, for aircraft equipped with EFBs and when technically feasible, should systematically compare the EFB take-off performance loggings with the relative FDM data to identify the take-off runway excursion risks.	Aircraft Operator.	<b>End of 2023</b>
<b>OPS34</b>	Aircraft operators, for aircraft equipped with EFBs and when technically feasible, should visualise on the EFB the FULL RWY with its planned TO RWY holding position to increase the situational awareness of the crew for the intended T/O position.	Aircraft Operator.	<b>End of 2023</b>
<b>OPS35</b>	Aircraft operators should consider observational procedures (e.g. Line Operations Safety Audits) to identify runway excursion safety risks precursors and best practices which cannot be captured by the traditional reporting or FDM.	Aircraft Operator.	<b>End of 2023</b>

## RECOMMENDATIONS TO AIRCRAFT MANUFACTURERS

REF	Recommendation	Action by	Implementation Date
<b>MAN1</b>	Aircraft manufacturers should present takeoff and landing performance information for dispatch and time-of-arrival for the full range of reportable runway conditions, using common and shared terminology and to agreed standards, set out in FAA ACs 25-31 and 25-32.	Aircraft Manufacturer.	<b>End of 2025</b>
<b>MAN2</b>	Training material promulgated by aircraft manufacturers and aircraft training providers should emphasize the necessity of making best use of deceleration means, including speed brakes, wheel braking and reverse thrust in a timely manner, until a safe stop is assured, and in particular when conditions are uncertain or when runways are wet or contaminated by applying full braking devices, including reverse thrust, until a safe stop is assured.	Aircraft Manufacturer.	<b>End of 2023</b>
<b>MAN3</b>	On-board real time performance monitoring and alerting systems that will assist the flight crew with the land/go-around decision and alert when more deceleration force is needed during the landing roll should be made widely available.	Aircraft Manufacturer.	<b>End of 2027</b>
<b>MAN4</b>	The aviation industry should develop systems and flight crew manuals to help flight crews calculate landing distances easily and reliably in normal and non-normal conditions. Systems should have a method to apply recommended assumptions. All landing distance computing tools available for the aircraft (FMS, EFB) and on-board real time performance monitoring and alerting systems (e.g. ROAAS, etc.) should be consistent with the overall harmonized set of data used for landing performance assessment. Whenever consistency between on-board alert triggering thresholds and landing distance computation methods available to the crew cannot be entirely achieved, means to determine these thresholds for the planned conditions and guidance to the flight crew on a recommended course of action should be provided.	Aircraft Manufacturer.	<b>End of 2025</b>
<b>MAN5</b>	Electronic Flight Bag manufacturers and providers should develop user interfaces for the calculation and data entry of the take-off and landing performance data, designed to minimise the possibility of errors introduced by the pilot.  EFB systems should enable the flight crew to perform independent determination of takeoff and landing data and to implement, where possible, an automatic crosscheck of inputs and to ensure correct insertion of the data in the avionics.  EFB systems should use terminology and presentation of data consistent with aircraft systems and aircraft documentation to the extent practical.  Standard Operating procedures should be developed to support a crosscheck of performance data by both pilots	Aircraft Manufacturer.	<b>End of 2025</b>
<b>MAN6</b>	Manufacturers should monitor and analyse (worldwide) runway excursions involving the aeroplanes they support and share the lessons learned – where feasible.	Aircraft Manufacturer.	<b>Ongoing</b>

REF	Recommendation	Action by	Implementation Date
<b>MAN7</b>	Manufacturers should provide information about effective crosswind landing and take-off techniques including in low visibility when required.	Aircraft Manufacturer.	<b>End of 2023</b>
<b>MAN8</b>	Manufacturers should consider a function able to: <ul style="list-style-type: none"> <li>- Use aircraft data to compute braking action (i.e. maximum achievable tire-runway friction when braking is friction limited).</li> <li>- Display it to the crew to assist pilot's braking action report to air traffic control (PiRep).</li> <li>- Convey it, just after landing, to airport operators and to the aircraft operator(s).</li> </ul>	Aircraft Manufacturer.	<b>End of 2027</b>
<b>MAN9</b>	Manufacturers should consider to make available flight deck functionality enabling an accuracy of the 3D aircraft trajectory with regards to the runway (including the touch-down point), especially for degraded visibility landings. For example, in order to satisfy this recommendation manufacturers could consider to make available: <ul style="list-style-type: none"> <li>- Expanded automatic landing.</li> </ul> Or <ul style="list-style-type: none"> <li>- Functions that provide additional information to the flight crew to improve positional awareness of the aircraft relative to the landing runway.</li> </ul>	Aircraft Manufacturer.	<b>End of 2027</b>
<b>MAN10</b>	Aircraft manufacturers and FDA service providers should provide adequate interfaces and consider developing additional services for Flight Data Analysis, to help operators identify precursors to runway excursions. For example, this could include services to identify: <ul style="list-style-type: none"> <li>- Discrepancies on runway surface conditions (comparing experienced conditions with ATC reported ones)</li> <li>- Reduced aircraft performance margins at landing or take-off,</li> </ul> by comparing actual data (such as deceleration and distances) with the expected aircraft performance according to manufacturer models.	Aircraft Manufacturer.	<b>End of 2027</b>
<b>MAN11</b>	Manufacturers should consider a real-time take-off performance monitoring function in order to reduce the risk of runway excursion during take-off, including aircraft performance related or wrong position scenarios.	Aircraft Manufacturer.	<b>End of 2027</b>
<b>MAN12</b>	Manufacturers should consider to make available systems that provide flight path and energy state awareness in order to aid the flight crew to better anticipate and maintain stability throughout the entire approach.	Aircraft Manufacturer.	<b>End of 2027</b>
<b>MAN13</b>	Manufacturers should provide recommendations in their operational documentation for the use of automatic braking when landing on wet or contaminated runways, when appropriate, to minimize delays in brake application.	Aircraft Manufacturer.	<b>End of 2021</b>

REF	Recommendation	Action by	Implementation Date
<b>MAN14</b>	Manufacturers should consider to make available on-board real time stabilized approach monitoring systems that provide alerts when there is a deviation from stable approach criteria. In those cases where other alerting systems are used in combination (e.g. ROAAS), the alerting systems must be consistent to avoid unnecessary go-arounds.	Aircraft Manufacturer.	<b>End of 2027</b>
<b>MAN15</b>	Manufacturers should provide on-board real time means to enhance position awareness with respect to runways on final approach and ground operations to addresses risks of aircraft lining up on: <ul style="list-style-type: none"> <li>- The incorrect runway for landing or departure.</li> <li>- A taxiway for landing or departure.</li> <li>- The incorrect intersection for departure.</li> </ul>	Aircraft Manufacturer.	<b>End of 2027</b>
<b>MAN16</b>	Whenever new functionality is created that is not supported by existing regulatory guidance, that functionality should be preferably supported by development of a MOPS by a standards organization.	Aircraft Manufacturer.	<b>Ongoing</b>

## RECOMMENDATIONS TO REGULATORS AND ICAO

REF	Recommendation	Action by	Implementation Date
<b>REG1</b>	Regulators should ensure that: <ul style="list-style-type: none"> <li>- The national/regional regulations are in line with the relevant ICAO standards and recommended practices; and</li> <li>- All infrastructure, practices and procedures relating to runway operations are designed and remain in compliance with such national/regional regulations.</li> </ul>	Regulators.	<b>Ongoing</b>
<b>REG2</b>	Regulators should enhance the focus on the prevention of runway excursions in their oversight activities by taking into account best practices (e.g. GAPPRE), in addition to their national/regional regulatory requirements.	Regulators.	<b>Ongoing</b>
<b>REG3</b>	Ensure that the risk of runway excursion is included as part of runway safety in the State Safety Plan and provide safety performance indicators to monitor/demonstrate the effectiveness of any State or industry initiatives.	Regulators.	<b>Ongoing</b>
<b>REG4</b>	As part of their oversight activities, Regulators should ensure close cooperation between ground handling service providers, aircraft operators, aerodrome operators and air navigation service providers, with regard to the prevention of runway excursions. This cooperation will be a part of an effective implementation of SMS of the relevant organisations, verified by the respective regulator through regular assessments and safety performance indicator monitoring.	Regulators.	<b>Ongoing</b>
<b>REG5</b>	Ensure that any noise mitigation rules required to be implemented by aerodromes should be subject to regular and coordinated hazard identification and risk assessment, to ensure they do not increase the likelihood of runway excursions, in particular in relation to operations on contaminated runways.	Regulators.	<b>Ongoing</b>
<b>REG6</b>	Ensure a continued focus on training for pilots, air traffic controllers, AFISOs, and aerodrome personnel, which includes runway excursion prevention. Ensure the continuous review and improvement of the respective training programmes by the regulator and Training Organisations, through the use of performance indicators.	Regulators.	<b>End of 2022</b>
<b>REG7</b>	Assess the performance of aircraft operators' processes for: <ul style="list-style-type: none"> <li>- Safety data collection (e.g. flight data monitoring and reporting).</li> <li>- Identification and analysis of precursors and causal factors.</li> </ul> Ensure that aircraft operators are participating in safety data sharing programs, e.g. Data4Safety.	Regulators.	<b>End of 2022</b>
<b>REG8</b>	As part of safety promotion, ensure GAPPRE is shared with relevant stakeholders to ensure that the causal and contributory factors of runway excursion continue to be understood, enabling organisations to further enhance effective runway excursion prevention measures.	Regulators.	<b>Ongoing</b>

REF	Recommendation	Action by	Implementation Date
<b>REG9</b>	States should assess the performance and success of safety information sharing networks among all users of the aviation system including the extent of free exchange of information on actual and potential safety deficiencies.	Regulators.	<b>Ongoing</b>
<b>REG10</b>	States should establish a national runway safety forum/ network which includes representatives from aircraft operators, ANSPs, aerodromes and regulators where best practices and learning can be shared. The National forum/ network should include key representatives from Local Runway Safety Teams. National best practices should be shared regional/globally through regional/global knowledge platforms.	Regulators.	<b>End of 2022</b>
<b>REG11</b>	States should measure the effectiveness of the GAPPRE recommendations, for example by collaboratively developing harmonised performance indicators or success factors.	Regulators.	<b>End of 2022</b>
<b>REG12</b>	REG12 a. Regulators and ICAO should consider and adopt regulatory measures for preventing visual confusion during line-up between runway edge and centreline lights leading to misalignment with the runway centreline. This should also take into account the effects of low visibility and runway contamination and the effect of using various light colours and patterns to differentiate the runway centreline and edge lighting systems. REG12 b. Regulators and ICAO should consider the guidance needs of the individual aircraft, and adopt provisions that disassociate the installation of taxiway centreline lights from the aerodrome traffic density.	ICAO and Regulators.	<b>End of 2025</b>
<b>REG13</b>	Except where runway TDZ lights are provided, regulators and ICAO should upgrade to a standard the use of simple TDZ lighting as an aid to enhance landing (touch down point) accuracy.	ICAO and Regulators.	<b>End of 2025</b>
<b>REG14</b>	ICAO should investigate improvements in marking and lighting systems that may enhance the simple TDZ lighting system.	ICAO.	<b>End of 2025</b>
<b>REG15</b>	ICAO should consider to upgrade to a standard the introduction of runway centreline lights for: - CAT I runways; - Runways used for take-off with RVR of the order of 400m or higher when the runway is used by high-speed aircraft, particularly where the width between the runway lights is greater than 50 m.	ICAO.	<b>End of 2025</b>
<b>REG16</b>	Support the development of approved signal in space SBAS models to allow certification of automatic landing on LPV 200 procedures as part of a broader initiative to promote and encourage the development of LPV 200 IFR procedures on a wider set of runways.	Regulators.	



REF	Recommendation	Action by	Implementation Date
<b>REG17</b>	Regulators and ICAO should launch initiatives or working groups having the objective to define a rulemaking baseline for video based navigation to supplement (and/or replace) traditional navigation means in the visual segment. Such capacity would allow enhancing availability of advance functions such as automatic landing and veer-off prevention warnings.	ICAO and Regulators	<b>End of 2025</b>

## RECOMMENDATIONS FOR R&D

REF	Recommendation	Action by	Implementation Date
<b>R&amp;D1</b>	Investigate a awareness and alerting system when an aircraft experiences abnormal/significant lateral deviation during final stages of the landing.	States, international organisations and the Industry.	<b>End of 2030</b>
<b>R&amp;D2</b>	Conduct research on transport-category aircraft, to extend automatic landing capacity to any runway states.	States, international organisations and the Industry.	<b>End of 2030</b>
<b>R&amp;D3</b>	Improve methods for assessing runway micro texture. Make pilots and aerodrome operators aware of the impact of a poor micro texture and of the shortfalls of current industry practice.	States, international organisations and the Industry.	<b>End of 2030</b>
<b>R&amp;D4</b>	Develop models for assessing runway wetness, particularly the depth.	States, international organisations and the Industry.	<b>End of 2030</b>
<b>R&amp;D5</b>	Explore the accuracy of and develop new automatic runway condition monitoring systems.	States, international organisations and the Industry.	<b>End of 2030</b>
<b>R&amp;D6</b>	Research ways to improve graded area of wet runway strips to mitigate the damage to aircraft when veering off a runway.	States, international organisations and the Industry.	<b>End of 2030</b>
<b>R&amp;D7</b>	Research and develop functions that provide additional flight path and energy information (e.g. such as FPV symbology) in order to help the flight crew to better anticipate and maintain stability at the gate and below	States, international organisations and the Industry.	<b>End of 2030</b>
<b>R&amp;D8</b>	R&D efforts should be conducted to develop on-board real time stabilised approach monitoring (upstream of ROAAS function at higher altitudes eg FL 200). Such systems should ensure that they are harmonized with other systems such as ROAAS and Runway Awareness and Advisory System (RAAS).	States, international organisations and the Industry.	<b>End of 2030</b>

# LIST OF ABBREVIATIONS AND ACRONYMS

ACARS	Aircraft Communications Addressing and Reporting System
AFISO	Aerodrome Flight Information Service Officer
AGL	Aeronautical Ground Lighting
ANSP	Air Navigation Service Provider
APM	Approach Path Management
ATC	Air Traffic Control
ATCO	Air Traffic Control Officer
ATIS	Automatic Terminal Information System
ATS	Air Traffic Services
DA	Decision Altitude
EASA	European Union Aviation Safety Agency
EFB	Electronic Flight Bag
FAA	Federal Aviation Administration
FCOM	Flight Crew Operating Manual
FDA	Flight Data Analysis
FDM	Flight Data Monitoring
FL	Flight Level
FMS	Flight Management System
FPV	Flight Path Vector
GAPPRE	Global Action Plan for the Prevention of Runway Excursions
GNSS	Global Navigation Satellite System
GRF	ICAO Global Reporting Format
ICAO	International Civil Aviation Organisation
IFP	Instrument Flight Procedure
ILS	Instrument Landing System
LDA	Landing Distance Available
LPV	Localiser Performance with Vertical Guidance
LRST	Local Runway Safety Team
LVP	Low Visibility Procedures
MDA	Minimum Descent Height
METAR	Meteorological Terminal Air Report
MOPS	Minimum Operational Performance Standard
NOTAM	Notice to Airmen
PAPI	Precision Approach Path Indicator
PM	Pilot Monitoring
R&D	Research and Development
RAAS	Runway Awareness and Advisory System
RESA	Runway End Safety Area
ROASS	Runway Overrun Awareness and Alerting System
RWY	Runway
SBAS	Satellite-based Augmentation System
SMS	Safety Management System
SOPs	Standard Operating Procedures
SPI	Safety Performance Indicators
TDZ	Touchdown zone
TEM	Threat and Error Management
TODA	Take-off distance available
TORA	Take-off Run Available

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Organisations that supported the initiative



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