EUROCONTROL

Information Paper

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ITEM 2.2

INFORMATION PAPER 04

Runway Safety

Submitted by - EUROCONTROL

SUMMARY

The work to improve runway safety in Europe is on-going.

Three important deliverables accompany this information paper.

Consultation on the new recommendations for the European Action Plan for the Prevention of Runway Incursions 2.0 is in progress.

RECOMMENDATIONS

The AOT is invited to:

a. Note the conclusions of the Operational Evaluation of Prototype Taxiway Rumble Features

b. Make use of the findings of the Runway Incursion Prevention Air / Ground Communication Study to continue to raise awareness of the operational issues leading to runway incursions.

c. Note the content of the Study of Runway Excursions from a European Perspective.

d. Note the progress of the European Action Plan for the Prevention of Runway Incursions 2.0

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1. Operational Evaluation of Prototype Taxiway Rumble Features

1.1 Deliverable

In response to Stakeholder requests, Eurocontrol conducted an operational evaluation to assess the potential value of a 'Taxiway Rumble Feature' as an additional runway incursion prevention measure.

The report describes the second phase of a project to study the possible introduction of taxiway rumble features on civil airports. The project was commissioned by Eurocontrol in support of the Runway Safety project. It forms part of ongoing work to develop strategies to support operational staff on the manoeuvring area.

The task involved the 'Operational Evaluation' (installation, monitoring and evaluation) of a prototype rumble feature on an operational taxiway at a civil airport.

Feedback from users of the Rumble Feature (i.e. pilots and airside drivers) was collected over a three month period of operational evaluation at Southampton International Airport.
Based on the feedback of the users, it was concluded that a tactile stimulus in the form of vibration was discernible by pilots and airside drivers. However, the stimulus was not recognised uniformly or unambiguously, and the feedback indicated no clear benefit in the assistance of situational awareness.

Typical comments included:

> "Not possible to differentiate between feature and taxiway conditions regularly encountered e.g. metal plates, taxiway lights etc."
> "Not possible to differentiate between rough tarmac and rumble strip."
> "Any use of permanent feature will not work because it will always have to be passed anyway when cleared. Simply use stop bars everyone knows what they mean."
> "Visual indicators are much better."

A significant proportion of responses indicated that the vibration was viewed as a distraction and that users would seek to 'tune out' the alerting stimulus.

It has been concluded that the Rumble Feature is ineffective as a runway incursion prevention measure because of the expected tendency for users to mitigate and thus avoid the alerting vibration. There was also a concern that, if pilots were to adjust their speed to minimise the vibration from the rumble feature, it could be a distraction from the operation of the aircraft.

For these reasons, work to develop this idea further will not be continued.

2. Runway Incursion Prevention Air / Ground Communication Study

2.1 Deliverable

As understanding of runway incursions grows, so do the number of reports available for fact based analysis and discovery of lessons learned.

- A review was made of 482 runway incursion incidents that took place in the period 2005-2009, in one European state. 53 cases were studied.

The top three communications related causes were:

- Entering the runway without a valid clearance;
- Non ICAO compliant phraseology use;
- A clearance/instruction/coordination misunderstood or ignored.

The findings of this study showed that:

1. Most incursions attributed to entering a runway without a valid clearance involved vehicles.
2. The majority of incursions using non ICAO compliant phraseology involved pilots who regularly use an aerodrome.
3. Pilots most commonly incurred where the clearance, coordination or other exchange was correctly given and acknowledged, but followed by a contrary / unpredictable action.
4. Forgetting about or misunderstanding about occupied runways happens most often when vehicles are on the runway or parts of the aerodrome are delegated to the aerodrome operator.
5. When pilots forget to readback or give only a partial readback the air traffic controller often overlooks to insist on the correct communication or take other action to prevent further movement until certain of correct understanding of the instruction.

Recommendations proposed in this report address the need to ensure that adequate information is collected on all incidents so that causal and contributory factors can be identified, lessons can be learned and disseminated e.g., in Case Studies created for training purposes.

Every runway incursion should be reviewed by the Local Runway Safety Team to ensure communication issues are thoroughly understood and robust solutions are implemented.

Even though recommendations specific to communication breakdown are present in the European Action Plan for the Prevention of Runway Incursions, there is still work to do to comply with ICAO provisions. Provision of adequate training to enable operational staff to work in a safe and effective manner seems to be key.

Finally, in addition to reviewing and improving local procedures and working practices, technology could be applied to provide simultaneous runway and traffic proximity alerts for Pilots, Air Traffic Controllers and Drivers.

3. A Study of Runway Excursions from a European Perspective

3.1 Deliverable

A runway excursion is the event in which an aircraft veers off or overruns the runway surface during either takeoff or landing. Safety statistics show that runway excursions are the most common type of accident reported annually, in the European region and worldwide.

In this report causal and contributory factors that may lead to a runway excursion are identified by analysing data of runway excursions that occurred during the period 1980-2008. The scope of this report includes runway excursions that have taken place globally with a focus on the European context. The study was limited to civil transport type of aircraft (jet and turboprop) involved in commercial or business transport flights. The final results were used to define preventive measures for runway excursions. Post incident / accident recovery after an excursion such as the use of Runway End Safety Areas or arrestor beds are not considered preventive measures, but mitigators of severity after the event and are excluded from this study.

The results of the study were discussed with a group of flight operational experts for validation, and presented to and discussed with, representatives of professional groups and aircraft manufacturers. The outcome of the discussions with the experts, professional associations and industry was used to refine the recommendations on preventive measures.

Based on the analysis of runway excursions the following main conclusions are made:

- The runway excursion rate has not shown significant improvement during the study period 1980-2008;
- Runway excursions that occurred in Europe have very similar causal factors as excursions that occurred elsewhere;
- The four types of runway excursions (takeoff overrun; takeoff veeroff; landing overrun; landing veeroff) show a similar frequency of occurrence for Europe compared to the rest of the world;
- Landing overruns and veeroffs are the most common type of runway excursion accounting for more than 77% of all excursions;
- 18 causal factors were prominent in all analysed runway excursions.

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4. European Action Plan for the Prevention of Runway Incursions 2.0

4.1 Consultation

Following the extensive contribution of the stakeholder organisations providing input to the European Action Plan for the Prevention of Runway Incursions, a wider consultation is in progress.

Although no comments were received from the last meeting of the AOT, the Safety Regulation Commission and the European Cockpit Association have made some proposals. The revised set of new recommendations is now available as Attachment 1. for consideration by the AOT.

ATTACHMENT 1.

European Action Plan for the Prevention of Runway Incursions 2.0

New Recommendations

Proposed changes to text from 30 March 2010 and 08 April 2010 are tracked.

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4.1 - General principles

#	Recommendation	Action
4.1.1	At individual aerodromes, as designated by the National Aviation Safety Authorities, a Runway Safety Team should be established and maintained to lead action on local runway safety issues.	Aerodrome Operators ANSP Aircraft operators
4.1.2	A local runway safety awareness campaign should be initiated at each aerodrome for Air Traffic Controllers, Pilots and Drivers and other personnel who operate on or near the runway. The awareness campaign should be periodically refreshed to maintain interest and operational awareness.	Local Runway Safety Team
4.1.3	Confirm that all infrastructure, practices and procedures relating to runway operations are in compliance with ICAO provisions.	Aerodrome Operators (lead) ANSPs (lead)
4.1.4	Where practicable, ensure that specific joint training and familiarisation in the prevention of runway incursion is provided, to Pilots, Air Traffic Controllers and vehicle Drivers. This may include visits to the manoeuvring area to increase awareness of signage and layout where this is considered necessary.	Local Runway Safety Team
4.1.5	Runway safety should be part of initial and recurrent training for operational staff e.g. Air Traffic Controllers, Pilots, vehicle Drivers and all other personnel involved in manoeuvring area operations.	Aircraft Operator, ANSP, Aerodrome Operators, NSA, Flight Training Schools
4.1.6	Ensure that adequate information is collected on all incidents so that causal and contributory factors can be identified, lessons can be learned and disseminated e.g., in Case Studies created for training purposes.	Aircraft Operator, ANSP, Aerodrome Operators Local Runway Safety Team
4.1.7	Changes to manoeuvring area practices and procedures, including planned works should take account of runway safety and may require consultation with the local runway safety team. An adequate risk assessment should be the basis for procedural and/or infrastructural changes On the manoeuvring area.	ANSP, Aerodrome operator, Aircraft operator

4.2 - Aerodrome Operator Issues

#	Recommendation	Action
4.2.1	Verify the implementation of ICAO Annex 14 provisions and implement maintenance programmes relating to Runway operations e.g. markings, lighting, signage. Ensure that signs and markings are clearly visible, adequate and unambiguous in all relevant conditions.	Aerodrome operators
4.2.2	Works in progress - Ensure that information about temporary work areas is adequately disseminated and that temporary signs and markings are clearly visible, adequate and unambiguous in all relevant conditions.	Aerodrome operators
4.2.3	Assess the need for additional ICAO standards for aerodrome signage markings and lighting. Make recommendations to ICAO where appropriate.	Working Group (ACI lead)
4.2.4	Implement safety management systems in accordance with ICAO provisions.	Aerodrome operators
4.2.5	Ensure a continued focus on runway safety in internal audit activities.	Aerodrome operators
4.2.6	Introduce a formal Driver training and assessment programme, or where already in place review against driver training guidelines.	Aerodrome operators
4.2.7	Introduce formal communications training and assessment for Drivers and other personnel who operate on or near the runway.	Aerodrome operators
4.2.8	Implement the ICAO standard naming convention for the manoeuvring area to eliminate ground navigation error and communication confusion.	Aerodrome operators (lead) ANSP (support)
4.2.9	Ensure all vehicles on the manoeuvring area are in radio contact with the appropriate ATC service, i.e. ground and/or the tower either directly or through an escort, including Emergency services.	NSA, Aerodrome Operators
4.2.10	Ensure all manoeuvring area Drivers are briefed at the start of a shift and that situational awareness is maintained.	Aerodrome Operators
4.2.11	Enable the tracking of vehicle movements on the manoeuvring area when possible.	Aerodrome Operators
4.2.12	Consider the safety benefits of a policy and robust procedure for Runway Inspections.	Aerodrome Operators, ANSP, NSA
4.2.13	New aerodrome infrastructure and changes to existing infrastructure should be designed to prevent runway	Aerodrome Operators

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#	Recommendation	Action
	incursions.	
4.2.14	The aerodrome operator should ensure that a procedure exists and Drivers are trained for those occasions where Drivers become uncertain of their position.	Aerodrome Operators
4.2.15	Avoid infringing lines of sight from the tower. Assess visibility restrictions from the tower, which have a potential impact on the ability to see the manoeuvring area. Disseminate this information as appropriate. Recommend improvement when possible and develop appropriate procedures.	ANPSs, Aerodrome Operators

4.3 - Communications (Language, Radiotelephony, Phraseologies and Procedures)

#	Recommendation	Action
4.3.1	To avoid the possibility of call sign confusion, use full aircraft or vehicle call signs for all communications with runway operations.	ANSPs (lead) Aircraft Operators (lead) Aerodrome Operators (lead)
4.3.2	Verify the use of standard ICAO RTF phraseologies.	ANSPs (lead) Aircraft Operators (lead) Aerodrome Operators (lead)
4.3.3	Use the ICAO read-back procedure (including Drivers and other personnel who operate on the manoeuvring area).	ANSPs (lead) Aircraft Operators (lead) Aerodrome Operators (lead)
4.3.4	Improve situational awareness, when practicable, by conducting all communications associated with runway operations using aviation English.	ANSPs (lead) Aircraft Operators (lead) Aerodrome Operators (lead)
4.3.5	Improve situational awareness, when practicable, by conducting all communications associated with runway operations on a common frequency. *(note - Aerodromes with multiple runways may use a different frequency for each runway)*	ANSPs (lead) Aircraft Operators (lead) Aerodrome Operators (lead)
4.3.6	Avoid ambiguity at an aerodrome by giving discrete RTF call signs to manoeuvring area vehicles, e.g. to avoid confusion with aerodrome infrastructure.	ANSP, Aerodrome Operators
4.3.7	Consider implementing a regular evaluation of radio telephony practices, by all users looking at such things as frequency loading and use of ICAO compliant phraseology.	ANSP, Aerodrome Operators, Aircraft Operators
4.3.8	If conditional clearances are used, in accordance ICAO provisions, ensure a policy and procedures are developed and implemented.	ANSP
4.3.9	Significant aerodrome information which may affect operations on or near the runway should be provided to Pilots 'real-time' using radio communication.	ANSP (lead)

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4.4 - Aircraft Operator Issues

#	Recommendation	Action
4.4.1	Provide training and assessment for Pilots regarding Aerodrome signage, markings and lighting.	Aircraft Operators (lead IAOPA (support)
4.4.2	Pilots shall not cross illuminated red stop bars when lining up or crossing a runway, unless contingency procedures are in force, e.g. to cover cases where the stop bars or controls are unserviceable.	Aircraft Operators
4.4.3	Ensure that flight deck procedures contain a requirement for explicit clearances to cross any runway. *Includes non-active runways.*	Aircraft Operators
4.4.4	Flight Crew should not enter a runway for departure if not ready to take off. Flight Crew must advise ATC on first contact with the Tower if additional time on the runway is required for operational reasons.	Aircraft Operators, ANSP
4.4.5	Promote best practices on flight deck procedures while taxiing and during final approach - to include the "Sterile flight deck" concept.	IATA, (lead) ECA/IFALPA (support)
4.4.6	Promote best practices for Pilots planning of ground operations.	IATA, (Lead) ECA/IFALPA (Support)
4.4.7	Ensure a means to indicate receipt of landing / line-up / take off / crossing clearances in the cockpit.	Airframe Manufacturer, Aircraft Operator
4.4.8	Pilots are advised to switch on forward facing lights when in receipt of a take-off clearance and show forward facing lights on the approach.	Aircraft Operators
4.4.9	Pilots must be aware of current safety significant airport information.	Aerodrome Operators/ Aircraft Operators
4.4.10	During taxi for departure or during approach, Pilots should not accept a runway change proposal if time to re-brief is not sufficient. This includes a change of departure intersection	Aircraft Operators, ANSP
4.4.11	If Pilots have any doubt as to their exact position on the surface of an aerodrome, they should contact ATC and follow the associated ICAO procedure (PANS-ATM, Doc 4444).	Aircraft Operators

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4.4.12	Pilots should be “head-up” for a continuous watch while taxiing.	Aircraft Operators
4.4.13	If there is any doubt when receiving a clearance or instruction, clarification should be immediately requested from ATC.	Aircraft Operators
4.4.14	Aerodrome charts or an equivalent electronic device should be displayed on the flight deck during taxi. This includes when operating at the home ~~base~~ aerodrome.	
4.4.15	Avoid accepting rapid exit taxiways for runway entry.	

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4.5 - ANSP Issues

#	Recommendation	Action
4.5.1	Implement safety management systems in accordance with ESARR3 provisions.	ANSPs
4.5.2	Ensure a robust procedure, and where practicable, appropriate technology to show an occupied runway.	ANSPs
4.5.3	Whenever practical give ATC en-route clearance prior to taxi.	ANSPs
4.5.4	If an aircraft or vehicle becomes lost or uncertain of its position on the aerodrome manoeuvring area, ATC should apply the associated procedure to re-establish full situational awareness.	ANSPs
4.5.5	Aircraft or vehicles shall not be instructed to cross illuminated red stop bars when entering or crossing a runway unless contingency measures are in force, e.g. to cover cases where the stop bars or controls are unserviceable. Stop Bars that protect the runway must be controllable by the runway controller.	ANSPs
4.5.6	Ensure that ATC communication messages are not over long or complex.	ANSPs
4.5.7	Ensure that ATC procedures contain a requirement for explicit clearances to cross any runway. *Includes non-active runways.*	ANSPs
4.5.8	Identify any potential safety benefits of carrying out runway inspections in the opposite direction to runway movements and if appropriate adopt the procedure.	Aerodrome Operators / ANSPs (joint activity)
4.5.9	Use standard taxi routes when practical to minimise the potential for pilot confusion, on or near the runway.	ANSPs
4.5.10	When necessary, for example at a complex airport, indicate the global taxi route and use progressive taxi instructions to reduce pilot workload and the potential for confusion.	ANSPs /tentative/
4.5.11	Avoid infringing sight lines from the tower and assess visibility restrictions from the tower, which have a potential impact on the ability to see the runway, and disseminate this information as appropriate. Recommend improvement when possible and develop appropriate procedures.	ANSPs/ Aerodrome Operators
4.5.12	Ensure that runway safety issues are included in training and briefing for ATC staff.	ANSPs

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4.5.13	Identify any potential hazards of runway capacity enhancing procedures when used individually or in combination and if necessary develop appropriate mitigation strategies. (Intersection departures, multiple line-up, conditional clearances etc.)	ANSPs
4.5.14	Consider delaying a line up clearance if the aircraft will be expected to wait on the runway for more than 90 seconds beyond the time it will normally be expected to depart.	ANSP
4.5.15	Avoid using oblique or angled taxiways for line-up that limit the ability of the Flight crew to see the runway threshold or the final approach area.	ANSP
4.5.16	When planning a runway change during taxi for departure or during approach consider the time a pilot will require to prepare/rebrief.	ANSP, Aircraft Operators
4.5.17	As far as practicable, controllers should be “head-up” for a continuous watch of aerodrome operations	ANSP

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4.6 - Data collection and Lesson sharing

#	Recommendation	Action
4.6.1	Promote the implementation of occurrence reporting compatible with an international harmonised reporting system e.g. ADREP 2000, ECCAIRS	National Aviation Safety Authority
4.6.2	Disseminate de-identified information on actual runway incursions to increase understanding of causal and contributory factors to enhance lesson learning.	National Aviation Safety Authority/ Aerodrome Operator/ ANSP/Aircraft Operator

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4.7 - Regulatory Issues

#	Recommendation	Action
4.7.1	Confirm that all infrastructure, practices and procedures relating to runway operations are in compliance with ICAO provisions.	National Aviation Safety Authorities
4.7.2	Make the appropriate regulations available to ensure implementation of safety management systems is in accordance with the applicable standards.	National Aviation Safety Authorities
4.7.3	Ensure that safety assurance documentation for operational systems (new and modified) demonstrates compliance with regulatory and safety management system requirements.	National Aviation Safety Authorities
4.7.4	National Aviation Safety Authorities should focus on runway safety in their oversight activities e.g. preventing runway incursion risks.	National Aviation Safety Authorities
4.7.5	Certify aerodromes according to ICAO provisions, Annex 14.	National Aviation Safety Authorities
4.7.6	Ensure that aerodrome operators and ANSPs regularly review the operational use of aeronautical ground lighting e.g. stop bars, to ensure a robust policy to protect the runway	ANSP, Aerodrome Operator. ATC, Aircraft Operators
4.7.7	Ensure that the content of training materials for Pilots, Air Traffic Controllers and Drivers working on the manoeuvring area includes runway incursion prevention measures and awareness.	National Aviation Safety Authorities
4.7.8	Consider the effect on runway incursion risk when designing noise management rules and when considering special requests, using adequate risk assessment.	National Aviation Safety Authority
4.7.9	Ensure an adequate risk assessment as basis for procedural and/or infrastructural changes on the manoeuvring area.	National Aviation Safety Authority

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4.8 - Aeronautical Information Management

#	Recommendation	Action
4.8.1	Ensure that the provision of the contents of aeronautical information is in accordance with the ICAO standards and recommendations.	ANSPs/AIS (lead) Aerodrome operators (support) Aircraft operators (support)
4.8.2	Providers of aeronautical databases and charts should establish a process with AIS, with the objective of ensuring the accuracy, timeliness and integrity of the data.	National Aviation Safety Authorities/ EUROCONTROL Agency/Aircraft Operator
4.8.3	Ensure that an accuracy feedback process exists for the users of aeronautical information.	EUROCONTROL (AIM)
4.8.4	The ergonomics of Maps and Charts and relevant documentation should be improved to enhance their readability and usability.	EUROCONTROL (AIM)
4.8.5	Aerodrome operators to provide aeronautical information in standard electronic format (AIXM) with ANSPs/AIS for upload into EAD.	Aerodrome operators (lead), ANSPs/AIS (support)
4.8.6	Regularly review all aeronautical information provided to ensure it is up to date and relevant to the pilot.	AIM, Aircraft Operators, Aerodrome Operator

4.9 - Technology

#	Recommendation	Action	Guidance
4.9.1	Improve situational awareness by adopting the use of technologies that enable operational staff on the manoeuvring area to confirm their location in relation to the runway e.g. via GPS with transponder or airport moving maps, visual aids, signs etc.	Aerodrome Operator, Air Navigation Service Provider, Aircraft operators.	
4.9.2	Promote the integration of safety nets to provide immediate and simultaneous runway and traffic proximity alerts for Pilots, ATC and Drivers.	Eurocontrol	

4.10 - Civil Military

#	Recommendation	Action
4.10.1	Where more than one aerodrome operator exists at a joint-use aerodrome, a leading aerodrome operator should be identified to secure a harmonised, consistent and coordinated application of the recommendations for the prevention of runway incursions.	MAA/NASA
4.10.2	New investment or reconstruction work on the manoeuvring area should be planned, coordinated and safety assessed between civil and military entities, in consultation with the Local Runway Safety Team.	MAA / NASA, Aerodrome owner/operator, ANSP, LRST
4.10.3	Differences in application of Civil and Military traffic procedures that can affect operational safety should be published in accordance with Annex 15, Aeronautical Information Services.	Aerodrome Operator, ANSP, AISP, MAA / NASA
4.10.4	Coordinate civil and military inspection/audit activities and subsequent safety recommendations accordingly with civil and military authorities.	NSA/MAA
4.10.5	Timely planning and coordination of aerodrome operations between civil and military aerodrome entities should be established as appropriate.	Aerodrome Operator
4.10.6	Standard ICAO phraseology should be in use during civil operations at joint use aerodromes. .	ANSP/Aircraft operator
4.10.7	When practicable procedures to use VHF frequency for communications or cross coupled UHF/VHF associated with runway operations should be developed for civil and military traffic operating simultaneously. The objective is to maintain the required level of situational awareness with civil and military Pilots, Drivers and controllers.	ANSP/ Aerodrome Operator
4.10.8	On the manoeuvring area, formation of aircraft should never be crossed / broken	ANSP/Aircraft operator
4.10.9	Conditional clearances should not be used for civilian traffic during military formation flight operations.	ANSP
4.10.10	Standard ICAO Annex 14 aerodrome signs, lights and markings should be used where civil and military share a manoeuvring area.	Aerodrome operator
4.10.11	Where ever practicable military aircraft should use	Aircraft operator

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#	Recommendation	Action
	onboard lights in accordance with ICAO Annex 2. If required, additional procedures should be applied to maintain the required level of situational awareness at joint-use aerodromes	
4.10.12	Ensure that military Pilots and airside vehicle Drivers who are temporarily deployed at civil aerodromes are competent to operate within the remit of ICAO provisions and local procedures.	MAA / NASA, Aerodrome operator, Aircraft Operator

5. Future work

#	Recommendation	Action
5.1.1	Information about the development of new technologies that can be applied to runway safety shall be disseminated as part of the general runway safety awareness campaign.	Steering Committee
5.1.2	Identify any ICAO guidance material that should be upgraded to ICAO standards and recommended practices and review other relevant materials.	Working Group
5.1.3	Conduct programmes to better understand the contribution of human factors to runway incursions.	Working Group
5.1.4	Review procedures and working methods at aerodromes to identify significant differences for Pilots, assess their potential impact on runway safety and recommend improvement when appropriate.	Working Group

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4.5.18	Ensure that air crews and ATCO's are not put under undue pressure attempting to meet noise abatement regulations that are focussed on curfews or preferential runway use.	This is a new undiscussed proposal by Marc Sterckx.

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4.7.8	Consider the effect on runway incursion risk when designing noise management rules and when considering special requests, using adequate risk assessment. Consider the effect on runway incursion risk when designing noise abatement rules and when considering special request via adequate risk assessment.	National Aviation Safety Authority
4.7.9	Ensure an adequate risk assessment as basis for procedural and/or infrastructural changes oin the manoeuvring area.	National Aviation Safety Authority

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4.7.9	Ensure an adequate risk assessment as basis for procedural and/or infrastructural changes oin the manoeuvring area.	National Aviation Safety Authority