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Agenda Item 5: Review of Task Force activities
5.2 Report of the Runway Incursion Prevention Task Force

RUNWAY INCURSION ISSUE

(Presented by the Rapporteur)

SUMMARY

This working paper is based on the experience of the members of the Runway Incursion Prevention Task Force and on the need to develop a guide to be used by CAR/SAM States to evaluate incidents and take the relevant measures to reduce and follow-up on the causes of runway incursions and their potential risk factors.

- References:

- Report of the AGA/AOP/SG/2 meeting, Agenda Item 6 – Review of other technical matters
- Report of the AGA/AOP/SG/3 meeting, Agenda Item 5 – Review of runway incursion prevention
- Presentation by IATA, GUIDE FOR THE PREVENTION OF RUNWAY INCURSIONS, FLIGHT CREW PROCEDURE by Captain JAN JUREK and SALVADOR LIZANA
- Air Operations Manual of the El Dorado International Airport
- Annex 14, Volume 1
- Annex 15, and Document 8126 – Aerodrome data, aeronautical information supplements
- Annex 17 Safety
- Document 9137, part 6 – Obstacle chart
- Document 9476 – Surface movement guide and control system
- Annex 3 – 4.7.4 and Document 9328 – Runway visual range
- Documents 4444 and 9426 part 3 – Control tower visibility
- Minutes of the Runway Incursion Seminar held in Chile

2. Analysis

2.1 Based on the information provided by the States during the presentations made by members of the task force on this issue, the following text is submitted to the consideration of the members of the AGA/AOP Subgroup for analysis, based on their experiences and the measures adopted by their respective States.

3. Suggested action

3.1 The strict compliance of ICAO standards and recommendations regarding operational procedures, phraseology, communications, operator training, and maintenance of facilities such as markings, lights, perimeter barriers and others, will lead to a reduction of incursions.

3.2 The following is the minimum information that the runway incursion registry should contain:

- State and city.
- Aerodrome.
- Date and time of the runway incursion.
- Detailed description of the runway incursion, including resulting damage and victims.
- Causes and analysis of the runway incursion.
- Measures taken to prevent the occurrence of similar incidents.
- Chart showing the location of the incursion at the airport.
- File containing the detailed recording of the incursion by the aerodrome operator.

3.3 Another suggested action is that the States implement a runway incursion prevention programme, in keeping with the specific conditions of each airport and the analysis of the causes of incursions.

3.4 Low visibility weather conditions require special attention and flight crew training for taxiing operations.

APPENDIX A

GUIDE TO THE PREVENTION OF RUNWAY INCURSIONS

1. INTRODUCTION

1.1 This Guide was developed bearing in mind the CAR SAM and AGA/AOP meetings held earlier, which put forward the need to create a Task Force on runway incursions in order to study the events that occur throughout the region and to gather data about runway incursion incidents in the CAR/SAM Region. It is based on incident reports and analyses of the causes and contributing factors and the establishment of measures to reduce incursions. States will develop a plan of action in the Region and initiate educational events concerning the subject.

Among the responsibilities of an aerodrome operator is to provide aircraft with safe displacement as of the moment they land and until they stop at a boarding bridge and vice versa. Several aspects could threaten aircraft safety during this process, such as runway obstructions caused by elements that should not be on the displacement path at that moment or invading the displacement paths of other aircraft.

In order to reduce this risk, it is essential for States, through airport operators, to study incidents that have occurred, identify their possible causes and establish procedures to reduce such events that affect aeronautical operation.

The following analysis will set forth some of the main causes identified by the organisations. It is warned that each country and airport possesses the potential for runway incursions, in accordance with local and socio-economic conditions, climate, location, fauna and terrain irregularities that should be identified and studied by operators.

Runway incursions are caused mainly by a lack of awareness of the location of the actors and no airport, whether or not it has a control tower or is used exclusively for general aviation, can be considered immune from an incursion. As a result, an accident could easily occur, unless the appropriate measures are taken.

Aircraft collisions constitute the greatest threat to safety in airports because of several different factors described below, stemming from major aviation catastrophes caused by runway incursions. Even so, any event in an airport area in movement involving an aircraft, vehicle, person, animal or object on the ground that creates a hazardous situation or results in the loss of separation with a aircraft that is taxiing or attempting to take off or land also represents a threat. This event should be studied as a possible runway incursion and measures taken to minimise its effect.

There are also other factors that can contribute to runway incursion, such as the lack of controller training, language, phraseology, communications containing inexact and incomplete orders, radios out of order, incorrect or ambiguous signalling.

2. OBJECTIVES

2.1. GENERAL OBJECTIVE

To establish the necessary procedures for avoiding the occurrence of aircraft ***RUNWAY INCURSIONS*** when landing, taking off, moving or remaining within an airport movement area like the runways, aprons and taxiways.

2.2. SPECIFIC OBJECTIVES

- To determine the potential runway incursion risk factors.

- To determine the possible causes of an obstruction of a moving aircraft.

- To raise awareness among the flight crews as to the importance of having operational procedures for taxiing.

- To familiarise airport operators with the detection of aspects that could cause runway incursions.

- To establish mechanisms for recording, monitoring and following up on incursions at each airport.

- To establish appropriate State planning to minimise cases of incursions.

2.3 DEFINITIONS

2.3.1. **RUNWAY INCURSION**: Any occurrence at an airport involving an aircraft, vehicle, person or object on the ground that creates a collision hazard or results in loss of separation with an aircraft trying to take off or land.

2.3.2. GROUND INCIDENT: Any event during unauthorised or unapproved movement within the movement area or occurrence in the movement area associated with the operation of an aircraft that affects, or could affect, safety.

3. CLASSIFICATION OF RUNWAY INCURSIONS

Runway incursions can occur between a pedestrian-aircraft, animal-aircraft, airport vehicle-aircraft and aircraft-aircraft due to many factors, both internal and external to the operation. However, the most important and most representative cases that have produced the greatest toll of victims in world aviation history are described below.

4. OPERATIONAL INCURSIONS BETWEEN AIRCRAFT

The greatest aviation tragedies have been caused precisely by the incursion and collision of aircraft themselves in airport displacement paths. For that reason, the main aspects that have contributed to accidents and incidents of this kind are examined below.

4.1. BACKGROUND

- In the past, the process of entering and leaving the runway was relatively simple, compared with other flight phases. Furthermore, little importance was given to formalising flight crew procedures during taxiing.

- In addition, organisations have not standardised training in cockpit procedures during airport ground operations, which are frequently given little attention.

- As a result, a variety of procedures and techniques are developed, based, for the most part, on the experiences of the cabin crew with what they consider to be correct at a given moment.

- This failure in structure, standardisation and formal training is inconsistent with the objective of enhancing the safety and efficiency of moving aircraft on the ground at airports.

- Recently, traffic increase, involving a large variety of aircraft at a given moment during peak hours, and the expansion of many airports, have resulted in a complex distribution of runways and taxiways.

- This additional complexity has made ground operations at airports more difficult and potentially more hazardous than in the past. In order to enhance safety and efficiency, hazards and risks must be minimised by keeping the workload in the flight cabin at its lowest level during taxiing operations.

- In developing these procedures, it is important to bear in mind the workload of the flight crew prior to take-off and landing. Some tasks that will simplify cabin workload should be considered, such as check lists, aircraft configuration for take-off and landing, the Flight Systems Management programme, and handling communications with the air traffic controller and with the airline.

- The more complex the cockpit activities, the more need there is for standard operational procedures for taxiing, which should be as simple, clear and explicit as possible.

4.2 TAXIING PROCEDURES FOR FLIGHT CREWS

Situations that can arise in the cockpit when aircraft are being moved from their aircraft parking stands to their runway take-off positions and from their runway landing positions to their aircraft parking stands are one of the most important aspects in the occurrence of runway incursions because they involve the crew in many flight planning activities, communications with the control centre, operational checking of aircraft equipment, and review of aircraft flight and manoeuvring plans along the taxiways and runway intersections assigned by airport control, as appropriate.

Taxi operations are generally not included in the flight phases, and hence they require a great deal of the attention of flight crews.

Furthermore, the problem is compounded in aerodromes without controls, because of the coordination that must exist among flight crews for safe aircraft displacement along runways and taxiways by establishing priorities for passing and for crossing them.

Clear, standardised and appropriate vertical and horizontal marking of runways, aprons and taxiways is another important element to be borne in mind in determining the location and route to be followed, as indicated by the controller for the taxi operation.

4.3. GENERAL CONSIDERATIONS

Runway incursions, which can cause potential incidents or accidents, can be reduced through appropriate planning, coordination and communications.

Some guidelines are given below to help flight crews handle airport situations during taxi operations. They are grouped together under the following subject headings:

A. Planning.
B. Situational awareness.
C. Use of written taxi instructions.
D. Verbal coordination among the flight crew.
E. ATC/pilot communication.
F. Taxiing.

A. PLANNING

- Planning of taxi operations is essential for their safety. Flight crews should pay the same attention to airport ground movement planning as to the planning of other flight phases.

- Planning should be carried out in two major phases:

a. Anticipation of airport ground movements through pre-taxi or pre-landing planning, based on the automatic terminal information service (ATIS) and previous experience at the particular airport.

Once the taxi instructions have been received, the pre-landing or pre-taxi plan should be revised and updated as needed. It is very important for all members of the flight crew to understand the updated plan.

The following situations can occur in planning pre-taxi and pre-landing:

- Flight crews expect to be assigned a particular taxiway, but receive different instructions from Air Traffic Control.

- Flight crews need to be certain they are following the current clearances and instructions, and not those they expected to receive.

- All flight crew members should study the following aspects during the pr-taxi and pre-landing phase:

  - Familiarisation by the flight crew with the airport

- Frequency of recent operations to or from this airport
- Recent changes in the airport infrastructure and maintenance and expansion work at the airport
- Review of effective NOTAMs for airport arrivals and departures, as regards construction, works and closing of runways and/or taxiways.

b. Flight crews should take the time to study the airport layout, using an airport diagram that should be kept up to date and made available for use by the pilots.

- They should check the planned route against the airport diagram or taxiway chart, paying special attention to intersections, whether single or complex.

- In planning departures, they should make sure, on arrival at an airport, to take into account the arrival taxiways.

- The flight crew should identify critical time periods and places along the taxiway (transition through complex intersections that cross intermediate runways, entering the take-off runway and preparing for take off, and approaching the landing runway and preparing to land).

- These are the places where verbal coordination between the PIC and SIC is important to ensure correct aircraft navigation and flight crew orientation.

- The flight crew should plan the right time for and execution of the aircraft checklist and the proper moment and place for communication, so that the pilot that is not taxiing the aircraft can communicate verbally with the pilot who is taxiing the aircraft. All of this should be done in order to fulfil ATC instructions for taxiing at the proper time and place.

- The flight crew, in planning these tasks, should also consider the expected duration of the taxi operation and the site of the complex intersection and runway crossing. During low visibility operations, the flight crew should carry out the pre-departure flight check only when the aircraft is stopped.

B. SITUATIONAL AWARENESS

- In carrying out taxi operations, the flight crew needs to be aware of the situation because of the relationship of the aircraft to other aircraft operating around it, as well as to other moving vehicles at the airport.

- The flight crew should, at all times, know the exact spot where the aircraft is located at the airport, particularly when visibility is low.

- The flight crew, when taxiing at the airport, should understand and follow the instructions and clearances of the air traffic controller; have and use an airport diagram, and use the visual aids available at the airport, such as signs, markings and lighting.

- The flight crew should use a continuous loop to actively monitor and update the progress and location of the aircraft during the taxi operation. This includes knowing its current location.

- It should mentally calculate the following place in the route that requires more attention to matters such as changes in taxiway, the runway intersection or other transition point. It is essential for the flight crew to share verbal information.

- Situational awareness increases if air traffic control instructions/clearances issued to other aircraft are monitored.

- Before entering or crossing any runway, it is important to confirm the position of the aircraft and, visual range permitting, to note the length of the runway, including the approach areas.

- The flight crew should verbally confirm the results of this verification with each other.

- The aircraft should stop moving and Air Traffic Control immediately informed if there is any discrepancy or if any member of the flight crew does not agree with the result of these verifications.

Precautionary measures:

- Do not stop on the runway. If possible, leave the runway and initiate communication with Air Traffic Control to find the bearings of the aircraft.

- Be particularly vigilant when instructions are received, especially at night or during periods of low visibility, to taxi to and hold a particular position on a runway.

- Do not remain in position or on the runway for a long period of time without communicating directly with Air Traffic Control. If any member of the flight crew is uncertain about any instruction or clearance, consult Air Traffic Control immediately.

- Check the radio and if a communication problem is suspected and flight conditions permit, watch the control tower to determine and identify the light signals.

- Maximum precautions should be taken in low visibility conditions when using a given runway or taxiway, especially at night.

- Within a short period after landing, take all possible precautions when occupying a runway that crosses another runway or taxiway.

- All flight crews should have a common understanding of Air Traffic Control instructions and of expectations regarding the spot where the aircraft should be stopped, and should be capable of identifying the holding points.

- If there is any doubt, immediately inform Air Traffic Control in order to fulfil any of its other instructions.

- When on the taxiway exit between parallel runways after landing, roll the aircraft clear of the landing runway, unless forced to stop by a short-wait queue awaiting the adjacent parallel runway.

- The landing runway must be cleared, unless otherwise instructed by Air Traffic Control, even if this means crossing or entering the taxiway/platform area.

- When the air traffic tower is operating, never enter a runway without receiving specific clearance to do so. If you have any doubt, ask Air Traffic Control to resolve it.

- At an airport without a control tower on at any airport where the control tower is closed, listen to the air traffic advisory service frequency. In the case of the arrival taxiway, review its total length, including the approach and departure end of the runway before crossing. Remember that all aircraft are not equipped with radios.

Flight crews, according to sterile cockpit procedures, should refrain from starting any unnecessary communication or action until the aircraft is clear of all runways.

C. USE OF WRITTEN INSTRUCTIONS FOR TAXIING

Taxi instructions can be very complex in many airports, involving numerous turns and transitions, runway crossings and instructions for pre-runway holding (holding nearby).

- Pilots are quite busy during these airport ground operations with different tasks and responsibilities that require their attention.

- A misinterpretation or the omission of a part of the taxi instructions could create a difficult or hazardous situation.

- Written taxi instructions, particularly complicated instructions, can reduce the possibility of the pilot forgetting part of complex instructions and can be used to support airport surface operations in the following way:

    a. For reference purposes, to check Air Traffic Control instructions.

    b. For flight crew coordination on the assigned runway and taxiway.

    c. For a short “briefing” before taxiing, before landing and on the pending airport surface operation.

    d. As a means for reconfirming the taxi route and any restriction at any time during the airport surface operation.

Written taxi instructions are a good operating technique and should be prepared with common sense and with some flexibility in determining flight crew needs at a specific airport.

For example, if the departure runway is too close to the aircraft parking area or if the flight crew has used the same taxi route several times in the last few days, it will only be necessary to record the basic elements of the taxi clearance.

However, if taxi instructions are not clear or the flight crew is not familiar with airport layout, a verbal transcription of all these instructions is advisable.

Furthermore, individual pilots can develop their own instructions that will enable them to clearly record, and afterwards recall, key data on taxi conditions at a particular airport.

D. VERBAL COORDINATION AMONG THE FLIGHT CREW

- It is very important for flight crews to correctly understand and be in agreement with all of the instructions of Air Traffic Control about surface movements.

- Any misunderstanding or disagreement should be resolved to the satisfaction of all the members of the flight crew BEFORE THE AIRCRAFT STARTS TAXIING.

- The most important thing about this coordination is the verbal aspect. All the members of the flight crew cannot be assumed to have heard and understood the instructions correctly.

- A flight crew member may strengthen a common understanding by repeating the instruction aloud, thereby reaching a common agreement on the intentions of an(other) flight crew member(s).

- Any continuing disagreement or doubt among flight crew members should be resolved by contacting Air Traffic Control for an explanation of the matter.

- At the moment a member of the flight crew confirms aloud that he/she understands the instructions, he/she will have the opportunity to discover and correct any mistake and, as a result, to prevent a hazardous situation. This verbal coordination/agreement should comply with the following:

    a. When Air Traffic Control issues a taxi instruction for departure, the flight crew should refer to the airport diagram, coordinate verbally and agree with the assigned runway and taxiway, including any instruction to “hold before” and points of intersection with other runways.

    b. When Air Traffic Control issues landing instructions, the flight crew should coordinate verbally and agree with the runway assigned by Air Traffic Control, as well as with any restriction, such as holding points before entering a runway intersection after landing.

    c. After landing and leaving the runway, the flight crew should coordinate verbally and agree with the aircraft taxi and parking instructions, including the instructions to “hold before” and about the points of intersection with other runways.

    d. At complicated intersections, the flight crew should coordinate verbally to ensure that the intersection is correctly identified and that the aircraft is in transition to the correct taxiway intersection.

    e. In approaching a runway intersection, the flight crew should coordinate verbally to identify that runway. It should also review aloud Air Traffic Control instructions to either keep to the runway or to cross it.

f. Before crossing or entering any runway to either take-off or land, both pilots should look to the right and left, including along the total runway length and its approach path and coordinate verbally if it is found to be clear.

g. Before entering the take-off runway, the flight crew should coordinate verbally regarding the correct identification of the runway and receive appropriate clearance from Air Traffic Control for take-off. A similar verification should be made during approach and landing.

h. When a flight crew member deems it necessary to cease monitoring any Air Traffic Control frequency, he/she should so inform (an)other flight crew member(s) on ceasing to monitor and resuming the monitoring of the frequency. Any information or instruction received or transmitted during the absence of a member of the flight crew should be reported and reviewed on his/her arrival.

i. When the pilot that is not taxiing the aircraft focuses on the instruments, *e.g.* on information entering the Flight Management System (FMS) and, as a result, is not in a position to visually monitor the progress of the aircraft, he/she should so advise the pilot that is taxiing the aircraft.

j. A report should also be made when the member of the flight crew completes his/her work and is once again able to visually monitor the taxi operation.

E. FLIGHT CREW COMMUNICATION WITH AIR TRAFFIC CONTROL

- The most important way to communicate with the flight crew and with Air Traffic Control is through voice communication.

- The safety and efficiency of taxi operations in airports with an operational control tower depends on this “communication loop.”

- Controllers use standard phraseology and need feedback and other responses from the flight crew in order to be certain that the clearance and instruction were understood.

- In order to complete the “communication loop,” controllers should also understand the feedback from the flight crew, together with other responses.

- The flight crew can contribute to the understanding by the controllers through appropriate responses and by using standard phraseology.

- The standard phraseology and the communication requirements are found in the AIMs, in approved flight crew training programmes, and in operating manuals.

Some of the most important guidelines that contribute to the precision and clarity of communications are:

- Keeping the cockpit “sterile.” Flight crew members should be capable of concentrating on their activities without being distracted by matters that have nothing to do with the flight (lunch, readings and material unconnected with the flight or unnecessary conversation). In cockpits without doors to separate the pilots from the passengers, the latter should be asked to avoid unnecessary conversation, also due to the specific flight regime.

- Using standard air traffic control phraseology all the time, in order to ensure that air traffic control/crew communications are clear and concise.

- Concentrating on Air Traffic Control instructions. Perform no unnecessary task while communications are being established with Air Traffic Control.

- Rereading the instructions on "hold before…" and runway intersections, including runway designators.

NOTE: Air traffic controllers need to have pilots read back the instructions for "hold …before runway."

Clarify any misunderstanding or confusion regarding Air Traffic Control instructions or clearances to the satisfaction of all cockpit personnel.

F. TAXIING

- The pilot will have to determine the aircraft manoeuvring speed according to its characteristics and the traffic on the taxiways.

- A copy of the airport diagram should be available for use by the flight crew before taxiing.

- Low visibility adds to the challenge of moving the aircraft along the airport surface without any hazards.

- When the RVR falls below 1200 feet, visibility over the taxi route may be considerably lower than existing visibility on the runway.

- Make the fullest possible use of all available resources, including heading indicators, airport signs, markers and lighting and airport diagrams to ensure that aircraft keep to their assigned taxi route.

- If the flight crew becomes uncertain about something, such as, for example, the location of the position aircraft in the movement area, STOP the aircraft and immediately advise Air Traffic Control. If necessary, ask for progressive taxi instructions.

- Give Air Traffic Control any available information about the position of the aircraft, such as, *inter alia*, signs, markings and prominent landmarks.

  PRECAUTIONARY MEASURES:

  Do not stop on the runway. If possible, leave the runway and communicate with Air Traffic Control to obtain guidance.

- When cleared to take-off or to cross or leave a runway, do so at the proper time. Inform Air Traffic Control about any delay that is foreseen.

- After landing, do not taxi toward another runway without Air Traffic Control clearance.

4.4. SUGGESTED POLICIES AND PROCEDURES FOR A TAXI OPERATION AT AIRPORTS WITHOUT CONTROL TOWER OR AIRPORTS WITH CONTROL TOWER THAT HAVE A LIMITED OPERATING PERIOD

4.4.1. General. The absence of a control tower at an airport in service creates the need for flight crews to be more vigilant.

- Application of specific communication procedures is different in these airports from in airports that have control towers.

- Taxi operations in this type of airport are unique and offer only a very limited chance for questions about the traffic.

4.4.2. PLANNING

- When planning to fly to or from such an airport, be absolutely certain about the operational status of the tower before undertaking any operation.

- Listen to broadcasts, when available, of advisory information about the designated frequency.

- Check to see that the information is correct when it is retransmitted to other members of the flight crew and for future reference during taxiing and take-off.

- When planning taxiing at an airport without a control tower, please keep the following in mind:

  - The familiarisation of the crew with the airport.

  - Frequency with which they have flown to and from that airport,

  - Changes in the airport since the last flight made there

  - Review of the latest NOTAMs and ATIS for information about airport departures and arrivals and about construction work under way at the airport, and closed taxiways and runways.

  - Study the airport layout and use the diagram to plan taxiing.

  - Consider the probability of incoming traffic without radio equipment, using the same airport.

  .

  - Remember: NOT ALL airports use a standard traffic pattern.

  - Do not forget to check the altitude of the traffic pattern

PRECAUTIONARY MEASURES: Be aware that, during calm winds or in conditions approaching calm winds, flight operations may take place on more than one of the airport runways.

- Furthermore, aircraft could be using instrument approach procedures for other runways, aside from that being used for VFR operations.

- The instrument approach runway may intersect with the VFR runway.

- Explain your taxi plan to your flight crew and make sure that everyone understands it.

4.5. SITUATIONAL AWARENESS

Situational awareness is important in all circumstances. When verbal assistance is not available from Air Traffic Control to tell the flight crew where and when to stop the aircraft, the flight crew must depend upon visual feedback to maintain awareness of the situation and of the planned taxi route. Markings, lighting, signs and airport diagrams are used in the same way as in airports with control towers.

Other measures to be taken are:

- Monitor the appropriate aeronautical frequency in the area and coordinate the entry into and exit from the runway and taxiway with other pilots.

- Monitor the approach control frequency to be alert to the arrival of IFR traffic at the airport.

- Examine the full length of the runway and determine possible crossings that conflict with the taxi operation and clearance of the runway.

- Advice of your taxi intent via the frequency and use external lighting to make your aircraft more visible.

4.6. AERONAUTICAL COMMUNICATIONS DATA

In aerodromes that have no permanent control tower, it is necessary to take further measures to ensure safe operation.

- Before starting to taxi, it is essential to check all applicable local communication standards and rules of the air.

  - Establish airport guides.
  - Plan the taxi operation.
  - Update current aeronautical data for the airport, including the operating schedule and the air traffic service schedule.
  - Make sure that a member of the flight crew monitors the communication facilities or radio aids.

- Taxiing for departure.

  Flight crews of departing aircraft should communicate/monitor the appropriate frequency as of the moment the engines are switched on and during taxiing, up to 10 miles from the airport, unless other local operational regulations and/or procedures or specifications are applicable.

  - Flight crews should announce all of their operational movements on ground over the appropriate frequency.

- Taking the runway.

- Flight crews should announce their intention to take-off over the appropriate frequency.

- Do not align the aircraft on the departure runway and hold. Stay there only the necessary length of time.

- From the beginning to the end of the radio transmission, always mention the name of the airport.

PRECAUTIONARY MEASURE: Inasmuch as some aircraft operating at airports without control towers may not carry radio equipment, flight crews should be on the alert for such aircraft.

4.7. USE OF EXTERNAL AIRCRAFT LIGHTS

- Exterior aircraft lights should be used to improve the visibility and identification of the aircraft by the controller and other aircraft.

- Pilots can use several combinations of exterior lights to report their position and intent to other pilots.

- Because aircraft equipment varies, flight crews must be cautious when switching on only the lights of the aircraft to determine the intention of the flight crews of the other aircraft.

External lights

- Switch on the external lights as fully and consistently as possible, according to the aircraft system, operational limitations and flight crew procedures, as follows:

- With the engine running, switch on the rotating beacon (anti-collision beacon) before moving and whenever the engine is running.

Taxiing

- Before starting to taxi, switch on the navigation, position, and anti-collision lights and the identification symbol. Stroboscopic lights should not be switched on during taxiing in order not to negatively affect the vision of other pilots or ground personnel.

- Intersection with departure and arrival runways.

- All external lights should be switched on.

- Do not use high intensity lights when waiting to cross a runway (on crossing, they can cause dizziness in flight crews).

- The same holds true for stroboscopic lights when there is fog.

- Switch on one or more landing lights and all other external lights when entering the departure runway for take-off or taxiing to a position and waiting to take off.

- Stroboscopic lights should not be switched on if they can impair the vision of other pilots.

Take-off

- Switch on the remaining lights once clearance to take off has been received or at the start of the take-off run in an airport with no operating control tower.

4.8. SUMMARY

Inasmuch as aircraft are the most seriously affected by RUNWAY INCURSIONS and in the light of the foregoing considerations, some recommendations are given below to try to mitigate these situations.

- Taxi operations call for constant vigilance on the part of the flight crew.

- Each member of the flight crew must be alert at all times to the movement and position of other aircraft and of ground vehicles.

- Taxi operations require the same planning, coordination and execution as other flight operational phases.

- STERILE cockpit discipline is always appropriate when taxiing, even under VMC conditions.

- Further vigilance is essential during taxi operations conducted under low-visibility conditions.

- Flight crews should pay special attention to Air Traffic Control instructions and should insist on correct feedback.

- Special attention should be paid to feedback, both in read-back and in communications heard between Air Traffic Control and other aircraft.

- Any ambiguity or uncertainty should be resolved as soon as possible so that it can be cleared up with Air Traffic Control.

- The flight crew should be prepared to stop the aircraft if any doubt exists over the Air Traffic Control clearance or the aircraft position when free from the active runway.

5. RUNWAY INCURSIONS CAUSED BY AIRPORT SERVICE VEHICLES

Service vehicles operate within the movement area of every airport and can represent a potential runway incursion hazard if diverted because of misinformation about the location of airport installations. For this reason, the relevant measures must be taken to provide proper training on the airport issue, especially to the drivers of those vehicles.

A large number of operational support vehicles can be found in the airport, among them:

- Ramp inspectors' vehicles, which can drive through all of the movement areas of the airport.

- Fuel supply vehicles, which drive mainly over the apron areas
- Fire fighting service vehicles, which drive over the entire movement area
- Ambulances
- Commercial support vehicles, which drive mainly over the apron areas
- Catering vehicles, which provision aircraft with food, and drive mainly over the apron areas
- Buses to serve aircraft in remote positions, which drive mainly over the apron areas
- The vehicles driven by airport infrastructure maintenance contractors (dump trucks and smaller machinery), depending upon the maintenance work required, can be found in any airport area. These are the people who need to be most careful because they are, in general, external personnel who are unfamiliar with airport regulations and will need a vehicle escort when driving within the facilities.

As can be noted, a large number of vehicles will be constantly circulating throughout the movement area. Strict control must be exercised over them to avoid their possible collision with aircraft. Any one of the drivers of the above-cited vehicles can cause a runway incursion or an incident with an aircraft that is circulating in the movement area.

For that reason, it is essential to record and analyse the cases that arise in the respective States for their study, evaluation and the designing of measures to be taken.

5.1. OPERATION OF VEHICLES IN THE MOVEMENT AREA

All vehicles that circulate in the movement area should, in general, have minimum equipment and be familiar beforehand with the special traffic rules and procedures regulating their particular activities within the airport, of which the following can be cited:

a. Be equipped with radio communications tuned to the airport frequencies.

b. Be identified and possess identification lights.

c. Bear clear identification of their use within the airport facilities.

d. Be familiar with the operating procedures.

e. Movements should be confined to the service areas or coordinated by the control authority.

f. A speed limit should be established for each apron area, except for emergencies.

g. Prohibitions should be clearly defined, such as:
   - Do not pass moving vehicles or aircraft
   - Do not get out of the vehicle
   - Do not drive in front of aircraft, except when it is a requirement of the service
   - Unauthorised transportation of passengers and leaving passengers at unauthorised places.

h. The parking location and places should be defined.

i. Rules should exist governing right-of-way (aircraft, pedestrians, emergency vehicles, and other vehicles)

j. Location of vehicle service areas

k. Procedures to be followed when radios are not operating

l. Procedures to be followed in case of vehicle accidents

m. Passenger vehicle driver requirements

5.2. EMERGENCY VEHICLES AND OTHER NON-ROUTINE VEHICLES

The airport operator should develop, within the aerodrome manual, the procedures for bringing in construction equipment that needs to enter the movement area, in order to avoid its diversion and a possible runway incursion during construction or maintenance work in the airport movement area.

In the case of emergency vehicles, the airport operator should ensure service during emergencies and, to that end, shall design the necessary procedures to guarantee the access of emergency vehicles to the sites where they are needed, bearing in mind aircraft taxi operations, and closing off airport areas of operations if conditions so demand.

The airport operator should provide all of the necessary regulatory signalling, both vertical and horizontal, to allow for the safe movement of aircraft and surface vehicles under low visibility conditions.

All persons driving vehicles in an airport movement area should receive and pass a training course in the special conditions involved in airport activity, covering subjects such as the following:

1. Airport safety and runway incursion incidents

2. Airport terminology

3. Vehicle operating requirements in connection with: vehicle identification and clearance, lights, insurance, routine inspections, parking, accident and incident reports, perimeter routes and aircraft lights.

4. Regulations: Drivers should be familiar with airport regulations and penalties.

5. Periodic examinations should be administered of the updated knowledge of the subject.

6. Penalties should be established for people who violate airport movement regulations.

Furthermore, authorised drivers, in order to drive in the movement areas, should be familiar with the following aspects about the airport and about communications:

About the airport:

Familiarisation with and identification and location of all airport components, the configuration of runways, taxiways, aprons, safety zones, control towers, the terminal, airport health structures, fire-fighters, power sub-stations, and airport perimeter landside roads.

Determination of areas that could lead to confusion.
Identification of airport runway lights (runway edges, touchdown zone, thresholds, runway approach lights) and taxiway lights (taxiway edges, thresholds, central lights and taxi holding positions).

Knowledge and identification of all airport signs, such as speed limits, horizontal and vertical markings in the movement area (holding positions, etc.).

Landing field markings, runway position, taxiway locations, ILS critical area markings, and the remaining distance markings.

Vehicle identification, signs and lighting.

About communications

Handling of ground vehicle communication equipment and frequencies.

Aviation phonetic alphabet phraseology.

Aviation terminology.

Procedures for contacting control towers.

Signal pistol identification and procedures.

5.3. Operational provisions for authorising vehicles to circulate in restricted areas.

With a view towards preventing runway incursions by vehicles, a model is presented below of the general aspects that should be included in the operating manual for vehicles that circulate in the movement area of airports.

All vehicles circulating in restricted areas should be driven by trained personnel, certified by holding a national driving license in the category that covers operation of a vehicle at the airport. Such personnel should also carry an airport driving license issued by the Operations Division after completing the following requirements:

- Written request addressed to the airport Operations Division, signed by the legal representative or Airport Manager of the interested enterprise, introducing the person requiring an airport driver's license and indicating his/her position in that enterprise.

- Photocopy of the applicant's national identification card, national driving license and identification issued by the Security Division of the airport where entry to the ramp area is authorised.

- Recent colour photograph containing basic information (name, national identification card number and enterprise) on the back.

- Having attended the course scheduled by the Operations Division on driving in ramp areas.

- The airport driving licence will be issued once the above requirements have been met.

- All airlines or airport service enterprises have the obligation to provide specific training to personnel responsible for operating specialised ground equipment, such as tow trucks, catering and health service vehicles, ladder trucks, buses and cargo hoists, etc. The enterprises will be the only parties responsible for incidents and/or accidents that occur as a result of the training given to their personnel.

- All vehicles should be driven on the right-hand side of the road demarcated with white lines. Crossing those lines is forbidden. Traffic moving straight ahead will have preference over turning traffic.

- If two vehicles come face-to-face with each other, each should keep to its right without entering the area intended for aircraft taxi operations or parking.

- Vehicles can leave the roads only to perform airport tasks, and only by leaving the road and driving in a direction perpendicular to their final destination.

- Parking in the area allocated for the circulation of vehicles is forbidden.

- Only vehicles that are providing supporting service to an aircraft can enter its security zone.

- The maximum speed limits for all vehicles circulating in the ramp area are:

    - Under normal operating conditions, thirty (30) km an hour.
    - When visibility is low and for night operations, fifteen (15) km an hour.
    - In ramp areas where aircraft move to parking positions, ten (10) km. an hour.
    - In the aircraft security zone, five (5) km. an hour.
    - Where circumstances demand, emergency, rescue and fire-fighting, airport security and ramp inspection vehicles are excepted from these speed limits.

- Vehicles are forbidden to circulate along aircraft runways or taxiways. Where circumstances demand it, ramp inspectors will coordinate with Air Traffic Services and escort the entry of vehicles to those areas, keeping in communication with the Control Tower, which will authorise the form of circulation.

- Vehicles cannot be used for purposes other than those specified in their corresponding permits.

- Transporting people in tow trucks, flatbed cargo trucks or vehicles that are not designed for that purpose is forbidden.

- Vehicles must follow the following order of preference in circulation:
  - Moving aircraft
  - Pedestrians
  - Vehicles

- Vehicles must at all times yield to rescue and fire-fighting vehicles and/or ambulances.

- Tall vehicles, such as front loaders or those used for cleaning and provisioning aircraft, should circulate with their equipment in the lowest position.

- All vehicles designed and authorised to tow equipment must be supplied with an appropriate hitching system that can be operated from the operator's seat.

- All equipment to be towed must be equipped with an independent braking system that must be set whenever the vehicle is parked.

- Drivers of towing vehicles are responsible for ensuring that the cargo and equipment are duly secured.

- Neither vehicles nor equipment can be parked in areas that are not duly demarcated and/or authorised for that purpose. Any that are found outside those areas shall be towed away by the Airport Bureau at the expense and risk of the owner.

- It is forbidden to park or drive vehicles under aircraft tail planes and cones, pedestrian ways or boarding bridges. The only exceptions are vehicles or equipment that are providing ground support to aircraft or performing infrastructure maintenance tasks.

- Vehicles are forbidden to park in such a way that they impede the rapid departure of fuelling and fire-fighting vehicles and ambulances or access to water hydrants or fire extinguishing equipment.

- Passengers cannot be picked up or left at airport sites that are not duly marked and set aside for that purpose.

- At night or when weather conditions so require, vehicles must circulate using their medium, but never high-beam, headlights.

- Anti-collision or blinking lights should be used whenever a vehicle is near aircraft movement areas, irrespective of the time of the day and continuously through the night or when meteorological conditions so demand.

- All drivers must heed the instructions given by the Ramp Inspectors or, where appropriate, the Control Tower.

- Drivers shall not leave their vehicles with the engines running. On parking, they must switch off the engine, leave the vehicle in gear and engage the hand or emergency brake.

- Under no circumstance may drivers operate under the influence of alcohol or of any narcotic drug.

- While parking next to an aircraft or leaving from that position, all vehicles must carry a person who acts as a guide, and who will point out to the driver the course to take. Once parked next to an aircraft, drivers must engage their hand brakes.

- In the event that an incident and/or accident involving a vehicle occurs at an airport, the Ramp inspectors must send the airport Operations Division a written report that should include:

- Date, place and time of the incident or accident

- Names of the people involved, including the enterprise or agency for which they work

- Type or class of vehicle involved, together with the license number and ramp operation permit

- Description of the circumstances in which the incident and/or accident occurred and its implications

- All vehicles, in the event of an emergency or of a need for service, have the obligation to collaborate as needed by the airport Emergency Committee.

- In all other aspects relating to this chapter, ICAO recommendations set forth in document 9476-AN/927 “Manual of Surface Movement, Guidance and Control Systems” and other complementary standards should be borne in mind.

6. RUNWAY INCURSIONS CAUSED BY PEDESTRIANS

A large number of people who are essential to airport activities and are always to be found within its facilities may also, due to a diversion, constitute a potential runway incursion or incident hazard.

For that reason, States must take the necessary measures to reduce those potential hazards to a minimum, while bearing in mind local cultural aspects, by establishing a procedure for doing so. To that end, several general aspects are set out below:

a. Personnel identification. All personnel present at an airport should carry with them an authorisation issued by the entity responsible for airport security, in the form of an identification card containing at least the basic data, such as: name, company for which he/she works, photograph, identification of permitted areas (magnetic strip or identifying colours), and wear the company uniform.

b. Training. The aerodrome operator, in order to issue the identification, must first verify that the applicant has received and passed a special training course on airports, in which he/she is taught about the duties, risks and responsibilities involved in working near aircraft and the protective measures that should be taken to avoid accidents.

c. In issuing the identification card, the areas the applicant can enter to perform his/her duties and those he/she cannot, will be established.

d. A penalty system must also be in place for transgressors, which could range from reprimands addressed to the enterprise for which they work to suspension of the permit to enter the airport facilities.

Due to the foregoing, it is essential to establish basic standards to guide the behaviour of people who circulate through restricted airport areas, in order to optimise safety conditions and prevent possible incursions into the undesired areas listed below.

1. People who enter restricted areas must abide by the applicable restrictions and recommendations laid out by ICAO, together with the regulations of Civil Aeronautics and airport management.

2. People authorised to enter restricted areas of the airport may remain there only so long as they are performing their duties.

3. In circulating within apron areas, all pedestrians must follow the demarcated routes and, if there are none, must skirt around the terminal buildings and never cross over the ramps.

4. Pedestrians may not, for any reason whatsoever, circulate over the aircraft manoeuvring area (taxiways and runways). People who must, in performing their duties, carry out tasks in those areas, may only enter them in vehicles, which should be escorted by the ramp inspector.

5. Pedestrians are forbidden to toss refuse in the airport apron areas. There should be an awareness of and a willingness to report the presence of such refuse to airport authorities.

6. Pedestrians have the obligation to report to airport management the presence of any unauthorised pedestrian in restricted areas of the airport.

7. Smoking in any restricted area of El Dorado airport is absolutely forbidden, except in the places specifically designated and authorised for that purpose.

8. In moving through ramp areas, pedestrians must always bear in mind the following order of preference:
   - Moving aircraft
   - Pedestrians
   - Vehicles

   They must, at all times, yield to rescue and fire-fighting vehicles and/or ambulances.

9. Pedestrians may not enter the aircraft security zone, except to perform their duties.

10. Pedestrians may not circulate behind or near moving aircraft planes, except when performing their functions.

11. Pedestrians may not circulate behind helicopters in operation and must keep a prudent distance between themselves and the helicopters.

12. Pedestrians who perform their functions in the apron area should use ear protectors and, for night operations or when the weather conditions so require, also reflective vests.

7. RUNWAY INCURSIONS CAUSED BY ANIMALS

Another cause of runway incursions, recorded in some States, are collisions between aircraft and large animals like, *inter alia*, cows, horses, sheep and large birds, for very local reasons, such as deficiencies in the construction and maintenance of fences or enclosing elements (barbed wire, chain link mesh, brick walls, military-type accordion fencing, insulation fences with drainage canals, etc.)

Poorly maintained green areas and drains can offer animals tempting food.

The failure of airport operators to provide the necessary management in this respect has caused accidents due to the runway incursion of animals that instinctively enter the movement areas.

There is the bird strike hazard, which is extensively analysed in other documents.

Nevertheless, States are especially recommended to consider the imminent declaration of an airport as an area restricted to the access of the public, which is generally responsible for breaking through fencing.

The airport operator should establish with local authorities the necessary mechanisms for avoiding the uncontrolled circulation of animal-drawn vehicles, bicycles, and pedestrians within airport facilities.

New airport projects need to consider their location in terms of possible runway incursions by airport neighbours.

8. SOLUTIONS AND RECOMMENDATIONS

In addition to the recommendations given in the summary of aircraft incursions, it is necessary for operators and users of the airport movement area to establish programmes to identify the causes and the seriousness of incursions and to reduce the probability of incursions by studying events, incidents and accidents recorded at the airport that caused or could cause an incursion and implementing an action plan encompassing the following aspects:

Training of all personnel involved with the airport; provision of technology that will contribute to the surveillance of aircraft and vehicle circulation; communication procedures; provision and operational verification of all airport signs, such as markings and lighting; data analysis and development of procedures applicable to the local situation.

These initiatives should include the following measures:

- Promote the participation of the aeronautical community in runway safety activities and providing solutions.

- Foster the training, instruction and awareness of pilots, controllers and vehicle drivers and operators.

- Publish advisory circulars for airport surface operations.

- Review the phraseology and language used in pilot – controller communications.

- Provide air carriers with training, instruction and situational awareness.
- Require all pilot tests and checks to be made and include a test on ground operations.
- Create a Runway Incursion Action Team.
- Promote the development and implementation of the AIRPORT AREA SAFETY SYSTEM.

- END -