

SAFETY NOTICE

SUBJECT: Prevention of Runway Incursion – Flight Deck Perspective

GENERAL: Safety Notices (SNs) are issued by the Civil Aviation Authority – Macao, China to convey advisory information to Macao aviation entities to enhance safety. SNs contain safety-related recommendations, guidance and/or industrial best practices to specific subjects which may or may not have been addressed by established requirements and regulations.

RELATED REGULATIONS: Nil.

APPLICABILITY: This SN applies to all Macao AOC holders.

CANCELLATION: This SN is the first SN issued on this subject.

REFERENCES: The following material was referred to for the development of this SN:

- ICAO Doc 9870 – Manual on the Prevention of Runway Incursion

1. Introduction

1.1 This Safety Notice is issued to enhance operator’s safety awareness on the prevention of runway incursion by providing flight deck best practices on the prevention of runway incursion and a highlight to some of the causal or contributory factors that have resulted in runway incursions which were identified during a runway safety survey conducted by EUROCONTROL.

2. Critical Phase of Flight

2.1 The number of ground movements on aerodromes has increased significantly over the last decades. To provide the needed capacity on the ground, it is necessary to continuously review the layout of the taxiway infrastructure and the increasingly complex taxiway systems at major aerodromes.

2.2 With the accelerated rate of enhancement and change at aerodromes in recent times, it is imperative that pilots remain aware of the signage and markings being applied. Every opportunity to familiarize oneself should be taken, and where possible, information critical to safe aerodrome operations should be shared.

2.3 The current generation of aircraft have highly automated and complex systems that allow the preparation and programming of the total flight to be done on the ground. This has resulted in flight deck workload peaks shifting to the ground phase of aircraft operations. This evolution is irreversible,

and appropriate mitigating measures should be taken to prevent runway incursions as a result. Consequently the taxi phase should be treated as a “critical phase of flight”.

3. Planning for Taxi Operations

3.1 A key point in the prevention of runway incursions is to apply preventative measures during the taxi phase. Prioritization of administrative and commercial tasks (such as weight and balance calculations, certain checklist items and the captain’s welcome speech) prior to leaving the ramp will assist in reducing the workload during the taxi phase and result in increased attention and improved situational awareness. This can be further enhanced by assigning one crew member to progressively monitor the progress of the flight against the aerodrome chart.

4. Aerodrome Familiarization

4.1 Preparations for departure and arrival at an aerodrome can be accomplished well in advance. Familiarization in preparation for the taxi operation is essential and should be completed at the gate or prior to starting descent as follows:

- a) prepare the necessary charts for taxi and have them available for use during taxi;
- b) take some time to study the aerodrome layout. Very often some system can be identified for the naming of taxiways;
- c) remember to review the latest NOTAM for both the departure and arrival aerodrome for information concerning construction or taxiway/runway closures. Visualize this information on the charts;
- d) standard taxi routes are used more often at busy aerodromes. Review the routes expected to be used. If not cleared for the expected taxi route, take adequate time to become familiar with the new routing even if it requires stopping to do so;
- e) pay special attention to the location of hot spots. These are locations on the aerodrome movement area where there is an increased risk of collisions. Know what runways will be encountered between departure and final destination;
- f) plan the timing and execution of checklists so that no distractions occur when approaching and/or crossing runways, i.e. all eyes outside during this phase; and
- g) conduct detailed briefings for all flight crew members, especially during night and low visibility operations, i.e. include “extra eyes” where available.

5. Briefings

5.1 The “before take-off” briefing should be simplified as much as possible. The pre-departure checklists should be gone through when the aircraft is stationary. Several taxi items can be addressed during the “before start” briefing at the gate. The briefing during taxi can be limited to a summary of the

highlights and the items which have been altered since the “before start” briefing. This should also be done during the “descent” briefing.

- 5.2 The “before start” and “descent” briefings should also contain a complete review of the expected taxi routes with special attention to the hot spots. Special attention should be paid to temporary situations such as work in progress, other unusual activity and recent changes in the aerodrome layout. During this part of the briefing, the aerodrome charts should be referred to and all available information visualized.
- 5.3 Memory is “constructive” in that one has the tendency to fill in the blanks. Pilots should ensure that they follow the clearance or instruction that has actually been received and not the one expected to be received. Also, expectations established during the pre-taxi or pre-landing planning can be significantly altered with a different and unexpected clearance.

BRIEFING CHECKLIST

- Conduct a briefing for all flight crew members.
- Become familiar with the aerodrome.
- Plan the timing and execution of checklists.
- Review the NOTAMs.
- Ensure that the flight crew fully understand all departure briefing items.
- Ensure that the briefing on the assigned taxi route is as thorough as that of the instrument approach.
- Ensure that the aerodrome diagrams are readily available to all flight crew members.

6. Taxi Procedures

6.1 Clearance

6.1.1 The receipt of any clearance and the taxi clearance itself require the complete attention of all the flight crew on the flight deck. If necessary, taxi instructions should be written down, especially at complex or unfamiliar aerodromes, and the instructions should be cross-checked against the aerodrome chart. Any uncertainties about clearance or position on the aerodrome should be clarified before the start of taxi or after vacating the runway. When unsure of taxi instructions, the pilot should stop, request clarification from ATC and continue taxiing only when the required taxi routing has been confirmed. In case of doubt, the pilot should ask for clarification.

6.1.2 All flight crew members should monitor the clearance for taxi, take-off and landing, and they must be kept informed at all times when runway operations are in progress.

6.2 Public Address Announcements

- 6.2.1 Public address announcements from the flight deck should be made a moment before engine start-up or push-back and not during the taxi phase. Safety reports show that public address announcements to passengers, or commercial announcements, are a direct source of error in many events. Also, operational calls on the company frequency can cause the other pilot to be isolated on the flight deck. These calls and announcements should, if possible, be avoided while taxiing and especially when approaching the active runway.
- 6.2.2 If it is necessary to leave the ATC frequency, the pilot should notify the other flight crew member and, afterwards, be briefed by that crew member of what may have been missed.

6.3 Taxi Best Practices

- 6.3.1 Only one pilot can control the aircraft during taxi and his/her primary task is to safely taxi the aircraft. The pilot not flying should assist the pilot flying to the best of his/her ability by providing guidance based upon the cleared taxi routing and the aerodrome layout map.
- 6.3.2 All checklist activity should be cancelled when crossing and entering runways. One flight crew member should maintain full concentration on the runway traffic situation.
- 6.3.3 Red stop bars should never be crossed when lining up on or crossing a runway unless, in exceptional cases, the stop bars, lights or controls are reported to be unserviceable, and contingency measures, such as using follow-me vehicles, are in force. In these circumstances, whenever possible, alternative routes should be used.
- 6.3.4 When entering any runway, all available surveillance means should be used to check for traffic (left and right), e.g. all eyes to be used.
- 6.3.5 When cleared to line up and/or when crossing any runway, the aircraft should be positioned at a right angle to the runway where possible, in order to better observe other traffic, both arriving and departing.
- 6.3.6 The pilot should not rush. The higher the ground speed, the less time available to react, manoeuvre the aircraft and avoid obstacles. High speed also results in greater distance and time required to bring the aircraft to a complete stop. Time can be both an ally and an enemy and should be used wisely. The pilot should taxi defensively and be prepared for others' mistakes.
- 6.3.7 When a clearance to taxi to a point beyond a runway is received, it must include the authorization to cross that runway. A runway should never be crossed unless an explicit ATC clearance has been received.
- 6.3.8 The "sterile flight deck" concept while taxiing should be adopted. During movement of the aircraft the flight crew must be able to focus on their duties without being distracted by non-flight-related matters. Cabin crew should be made aware of this requirement if it is not a standard operating



procedure. The following definition of a “sterile flight deck” is offered as a reference: *Sterile flight deck - Any period of time when the flight crew should not be disturbed, except for matters critical to the safe operation of the aircraft. Disturbances may include, but not be limited to, calls received from non-operational areas (e.g. company), entry onto the flight deck by cabin crew, and extraneous conversations not related to the current phase of flight.*

6.3.9 It is generally accepted that the need for a sterile cockpit commences as follows:

- a) departure: when the aircraft engine(s) are started and ceases when the aircraft reaches 10,000 feet elevation above the departure aerodrome;
- b) arrival: when the aircraft reaches 10 000 feet elevation above the arrival aerodrome until the engine(s) are shut down after landing; and
- c) at any other time determined and announced by the flight crew (e.g. in-flight emergency, security alert).

6.3.10 All aircraft lights should be used to help controllers and other pilots to see the aircraft. Fixed navigation lights and taxi lights should be on whenever the aircraft is moving. Landing lights should be turned on when cleared for take-off.

6.3.11 The audio box and volume adjustment should be checked whenever a frequency change is made. All flight crew should be on the appropriate frequency until all runways have been vacated after landing.

6.3.12 After landing, the runway should be vacated as soon as possible, but not by turning onto another runway, unless specifically instructed to do so. When the aircraft has vacated the active runway, the pilot should be prepared to stop to resolve any questions about the ATC clearance or about the aircraft position.

6.3.13 Anytime there is uncertainty about the location of the aircraft on the movement/manoeuvring area, the pilot should stop the aircraft, advise ATC, and seek clarification. Questions should be taken out of the flight deck. If necessary progressive taxi instructions should be requested.

6.3.14 The aircraft should never be stopped on a runway unless specifically instructed to do so.

PPREPARATION FOR TAXI CHECKLIST

- If necessary write down the taxi route.
- Assign a crew member to progressively follow the aircraft's position on the aerodrome chart.
- Follow company SOPs with regard to exterior lighting when taxiing and cleared for take-off – where possible, have maximum illumination.
- Adopt a sterile flight deck for the taxi phase.
- Be aware that the visibility required for taxiing may be less than the runway visual range (RVR).
- Be alert for mandatory signs, markings, stop bars and runway guard lights.
- Look for visual aids such as taxiway location information and destination signs.
- Designate a crew member to look for and report signs and markings and keep track of the aircraft's location against the aerodrome chart.
- Conduct pre-departure checklists when the aircraft is stationary.
- Use standard radio phraseology.
- Receive explicit clearance before crossing any runway.
- Read back all runway crossing or hold short clearances using correct phraseology.
- Do not be rushed by any party (ATC or company).
- Listen to clearances issued to other aircraft.
- Never cross 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.
- Before entering or crossing any runway, check for traffic.
- Cancel any checklist activity when crossing any runway.
- Ensure you have a correct understanding of the ICAO phraseology "taxi to holding point"
- Beware of the fundamental difference between the phraseology "position and hold" (which has the same meaning as the ICAO standard phrase "line up [and wait]") and the standard ICAO phraseology "taxi to holding point" (which means taxi to, and hold at, the runway-holding point). Listen carefully to the instruction. If unsure – ask.

6.4 Language

- 6.4.1 While the language normally used by the station on the ground or the English language is allowed, the use of standard aviation English at international aerodromes will enhance the situational awareness of all those listening on the frequency.
- 6.4.2 Conducting and comprehending radiotelephony communications requires competence with standard phraseology as well as general proficiency in the language used for communications. Standard phraseology should be used at all times. Strict adherence to standard phraseology prevents miscommunications.
- 6.4.3 Speaking slowly is essential when operating in foreign regions. When the speech rate is slowed, the response may be slower and clearer.

6.5 Readbacks

- 6.5.1 All clearances require a readback. The Standard in ICAO Annex 11, 3.7.3.1, states: “The flight crew shall read back to the air traffic controller safety-related parts of ATC clearances and instructions which are transmitted by voice. The following items shall always be read back:
- a) ATC route clearances;
 - b) clearances and instructions to enter, land on, take off from, hold short of, cross and backtrack on any runway; and
 - c) runway-in-use, altimeter settings, SSR codes, level instructions, heading and speed instructions and, whether issued by the controller or contained in ATIS broadcasts, transition levels.”
- 6.5.2 All readbacks require a hearback. In order to complete this “communication loop”, the readback must be complete and clear. The full clearance, including the call sign and runway designator, must be read back. “Roger” is not considered to be a readback.

6.6 Listen to the Frequency

- 6.6.1 The pilot should listen on the frequency at all times and try to visualize the other traffic in the vicinity. The pilot should know what runways will be encountered between the aircraft’s current location and final destination. Particular attention should be paid to all clearances and instructions issued to traffic involving those runways.

7 Other Communication Best Practices

- 7.1 Extra attention is required when other aircraft with similar call signs are on the frequency.
- 7.2 An instruction to follow other traffic does not automatically include clearance to enter or cross a runway. Each aircraft requires a specific clearance to enter or cross any runway. If in doubt, clarification should be sought.

- 7.3 If an aircraft has been cleared to “line up and wait”, then only a short delay on the runway should be anticipated. If in this position for an extended period, the pilot should advise ATC and seek clarification.
- 7.4 Both the pilot flying and the pilot not flying should monitor the frequency and agree upon the acceptance of a clearance to taxi, cross a runway, take-off or land on a runway. Any misunderstanding or disagreement should be resolved immediately by contacting ATC for clarification.
- 7.5 The use of headsets improves the audibility of communications with ATC and on the flight deck.
- 7.6 The correct setting of the audio panel should be verified, especially after any temporary switch in audio sources.
- 7.7 The pilot should state the position of the aircraft on the aerodrome whenever making initial contact with any ground or aerodrome controller, regardless of whether it was previously stated to a different controller.
- 7.8 The “sterile cockpit” rule during the taxi phase should be adopted.

8 SITUATIONAL AWARENESS

- 8.1 One aspect of situational awareness is pilots knowing where they are and where they want to go, as well as visualizing a picture of the airport traffic in the vicinity. Even during daylight and in good visibility, pilots can get lost. Even worse is the situation where pilots think they know their position, but find themselves elsewhere. In darkness or low visibility conditions, additional care must be taken to ensure that accuracy in navigation on the ground and the highest degree of situational awareness is maintained by all members of the flight crew.

SITUATIONAL AWARENESS CHECKLIST

Before starting the approach:

- Obtain all needed information.
- Briefing flight crew about planned primary runway exits and taxi routes.
- Eliminates as much distraction as possible.
- Have the aerodrome diagram available for instant use.
- Maintain situational awareness on final approach at night.
- Listen for clearances to other aircraft.

8.2 Visual Aids

8.2.1 Charts, signs, markings and lighting are all aids to assist in determining position. A high level of awareness must be maintained to observe and respond to mandatory signs and markings. Correct knowledge of all symbols and signs is therefore necessary. All the visual information that is available should correlate with the actual situation. Gathering visual information and constantly questioning and crosschecking the aircraft's position is the task of the entire flight crew. A crew member who is in doubt or does not agree with something must speak up.

8.2.2 A head-down situation during taxi should be limited to the minimum amount of time possible.

8.2.3 When the pilot not taxiing the aircraft focuses on the instruments on the flight deck, that pilot is not able to monitor the progress of the aircraft. Before undertaking head-down actions, the other pilot should be so advised so that the navigating pilot can place added emphasis on maintaining navigational accuracy and situational awareness.

8.3 Other Aids

8.3.1 Heading displays or compasses should be used to confirm runway or taxiway alignment with the information available from the charts. If available, the ILS centre line guidance system should be used to confirm correct runway alignment.

8.3.2 The entire runway and approach should be scanned in both directions before entering a runway and, if in doubt, clarification should be sought.

9 Conclusion

RUNWAY INCURSION PREVENTION CHECKLIST

- Strictly adhere to all relevant ICAO Standards and Recommended Practices, procedures and guidance material, including phraseologies.
- Ensure that flight crew follow the clearances or instructions that are actually received and not those they expect to receive.
- Ensure good planning of ground operations in order to decrease the workload during taxi. The flight and its associated risks start during the preparation.
- Ensure that good situational awareness is the top priority during taxi and involve all crew members.
- Make “crew resource management” principles during taxi as important as during the other phases of flight.
- Be defensive and let the built-in safety nets do their work so that a single mistake does not lead to a serious incident or accident.

10 Stop Bars

10.1 The following extracts from ICAO Standards and Recommended Practices are provided to assist flight crews in understanding the use and application of stop bars:

10.2 Annex 2 — Rules of the Air, Chapter 3:

- a) “3.2.2.7.3 An aircraft taxiing on the manoeuvring area shall stop and hold at all lighted stop bars and may proceed further when the lights are switched off.”

10.3 Annex 14 — Aerodromes, Volume I — Aerodrome Design and Operations, Chapter 5:

- a) “5.3.19.9 Selectively switchable stop bars shall be installed in conjunction with at least three taxiway centre line lights (extending for a distance of at least 90 m from the stop bar) in the direction that it is intended for an aircraft to proceed from the stop bar.”
- b) “5.3.19.13 Note 1.— A stop bar is switched on to indicate that traffic stop and switched off to indicate that traffic proceed.”
- c) “5.4.3.35 A taxiway shall be identified by a designator comprising a letter, letters or a combination of a letter or letters followed by a number.”
- d) “5.4.3.36 **Recommendation.**— When designating taxiways, the use of the letters I, O or X and the use of words such as inner and outer should be avoided wherever possible to avoid confusion with the numerals 1, 0 and closed marking.”
- e) “5.4.3.37 The use of numbers alone on the manoeuvring area shall be reserved for the designation of runways.”

10.4 Procedures for Air Navigation Services — Air Traffic Management (PANS-ATM, Doc 4444), Chapter 7:

- a) “7.14.7 Stop bars - Stop bars shall be switched on to indicate that all traffic shall stop and switched off to indicate that traffic may proceed. *Note.*— *Stop bars are located across taxiways at the point where it is desired that traffic stop, and consist of lights, showing red, spaced across the taxiway.*”

11. Recommended Actions

11.1 Operators are encouraged to note and disseminate the information promulgated in this SN to its flight crew members;

11.2 Directors of Flight Operations, Chief Pilots, Fleet Managers and Training Managers are encouraged to review their company’s policies, procedures, and training programme to reflect the safety issues contained in this SN.

- End -