



International Civil Aviation Organization

MIDANPIRG Air Traffic Management Sub-Group

Tenth Meeting (ATM SG/10)
(Jeddah, Saudi Arabia, 20 – 23 October 2024)

Agenda Item 3: Planning and Implementation issues related to ATM/SAR

A MODEL FOR OPTIMAL RUNWAY SELECTION

(Presented by Saudi Arabia)

SUMMARY

This paper presents the relationship between runway and all wind types, aiming to shed light on their combined impact on various aspects of air traffic operation, considering the forces that act on an airplane in flight, and operational procedures to ensure optimal runway selection and change procedures in timely manner , particularly in response to varying uncontrolled wind factors, which impacts air traffic operational efficiency, safety, and environmental sustainability.

Action by the meeting is at paragraph 3.

REFERENCE

PANS Doc 4444 - Air Traffic Management
Annex 3 - Meteorological Service for International Air Navigation
Annex 6 - Operation of Aircraft
Annex 14 – Aerodromes

1. INTRODUCTION

1.1 The selection of runways for air traffic operations, as outlined in Air Traffic Management (PANS 4444), is a cornerstone of ensuring efficient, safe, and sustainable aviation. By optimizing runway usage, Air Traffic Controller Officers (ATCO) can minimize delays, disruptions, and environmental impacts while maximizing airport capacity. Paragraph 7.2 of PANS 4444 provides the essential framework for this decision-making process, outlining the key factors that controllers must consider when determining the most suitable runway for a given operational scenario.

1.2 The Saudi ANS provider (Saudi Air Navigation Services) conducted a comprehensive study, in collaboration with key stakeholders, to establish a baseline for runway selection and change operational procedures incorporating the guidelines in PANS 4444 – Para 7.2, while placing particular emphasis on wind factors as a central consideration for ATCOs’ decision-making among other factors in reference to the applicable ICAO SARPs and documents.

2. DISCUSSION

2.1 Through the understanding of the characteristics of tailwind and crosswind components, runway operation management, and the operational procedures, ATCO can make informed decisions to mitigate risks and ensure the safety of aircraft and passengers.

2.2 When discussing the "wind effect" it is crucial to understand the classifications of wind types in reference to two parameters as follows:

a) Wind types in reference to **direction**:

1. Headwind. A wind blowing directly against the aircraft's movement within a range of +/- 30°, will decrease the airspeed and increase the aircraft's drag.
2. Tailwind. A wind blowing directly with the aircraft's movement within a range of +/- 30°, will increase the airspeed and aircraft's thrust.
3. Crosswind. A wind blowing in other directions than a headwind or tailwind with more than 30° in one of both sides (*across the runway*) requiring adjustments in control to maintain course.

b) Wind types in reference to **speed**:

1. Calm Wind. When the wind speed of less than 1 kt is reported.
2. Gust Wind. When the variations from the mean wind speed during the past 10 minutes exceeds the mean speed by 10 kt or more posing challenges for aircraft control.
3. Variable Wind. When it is not possible to forecast a prevailing surface wind direction due to its expected variability, for example, during light wind conditions less than 3 kt or thunderstorms, the forecast wind direction shall be indicated as variable using "VRB".

2.3 Crosswind is the component of wind that is blowing across the runway, making landings and take-offs more difficult than if the wind were blowing straight down the runway. In reference to crosswinds, all aircraft have a "max allowed crosswind" speed that is indicated in the pilot's operation handbook.

2.4 A tailwind blows in the same direction as the aircraft's movement. While it may seem beneficial, it also presents challenges.

2.5 In addition to the factors affecting the selection of runway in Doc 4444 (Para 7.2), the following other factors should be considered in changing runway-in-use:

- a) Pilot Request and ATCO shall advise the pilot to expect delay (*if applicable*).
- b) Emergency situation.
- c) Operational situation flow in congested airports.
- d) Significant changes in wind speed and direction in one or more of the following, the ATCO shall change the runway when:
 1. The crosswind component, including gusts, **exceeds 15 kts**.
 2. The tailwind component, including gusts, **exceeds 5 kts**.

2.6 The following **operational procedure** ensures aircraft utilize the most suitable runway based on prevailing wind conditions, and other applicable operational factors:

- a) Runway-in-use Change Initiation: Decision-making, ATCO in the related Aerodrome Control Tower is responsible for making the decision to change the runway-in-use based on:
 1. Wind direction and speed: Ideally, aircraft should take off and land against the prevailing wind for optimal performance and safety.
 2. Consider all other factors in Point 2.5 as appropriate.
- b) Disseminating Information and Coordination:
 1. Effective communication between all stakeholders is crucial for a smooth and safe transition to the new runway.
 2. The Tower ATCO should (*as applicable*):
 - Inform all related traffic under their AoR.
 - Inform the related Approach Unit.
 - Update the ATIS/D-ATIS to inform the inbound flights (*outside the AoR*).
 3. The Tower Supervisor should (*as applicable*):
 - Inform Aerodrome RFFS.
 - Inform the Airport operator.
 - Inform any other entities as required (*As per Local procedures*).
- c) Runway-in-use Change Activation: In case the change of runway-in-use will take effect, Tower ATCO should follow the following steps for better flow and less traffic delays:
 1. Stage 1:
 - Condition 1: Changing the runway caused by crosswind (*15 kt or more*) or tailwind (*5 kt or more*), wind shear, or any other applicable factors. or
 - Condition 2: Changing the runway due to pilots' reports of crosswind or tailwind affecting the flights for a long period or when required by ATCO judgment.
 - Action: ATCO should coordinate with APP for an immediate runway change (*TWR will not accept more than two flights – if applicable - on the current RWY configuration*).
 2. Stage 2:
 - Condition: Changing the runway for operation enhancement, if crosswind (*less than 15 kt*) or tailwind (*less than 5 kt*), wind shear, or any other applicable factors.
 - Action: ATCO should use the preferable runway unless other factor(s) may enforce different selection such as emergencies, landing priority, operation conditions, etc....

However, in all two stages, the following measures should be implemented by ATCO as applicable:

1. Consider the runway changes will take effect when the traffic situation permits; to ensure the safety of ATS operations.
2. After the last arrival, change ILS and Runway lighting to the new Runway.

3. Advise all traffic that will be subject to delay if the wind component or other factor urges runway change.
 4. Coordinate with other ATCO (*multi positions tower*).
 5. Coordinate with GND ATCO (*if applicable*).
 6. Revise ATC clearances for the related departure and arrival flights under his AoR.
 7. Update all flight plans (*in ATM System if available*) for the related departure and arrival flights under his AoR.
- d) Approach Procedure: In case the change of runway-in-use will affect the current operation, the related Approach ATCO should:
1. Inform all related arrival flights under his AoR.
 2. Revise ATC clearances for the related arrival flights under his AoR.
 3. Update all flight plans in the ATM System for the related arrival flights under his AoR.
 4. Use the speed control as applicable.
 5. Sequence the related arrival flights under his AoR in an efficient manner to avoid any extra delay.
 6. Inform the related Aerodrome Control Tower of the new arrival flights' new sequence (*as required*).

3. ACTION BY THE MEETING

- 3.1 The meeting is invited to note the information contained in this paper.