

WIND ROSE ANALYSIS AND RUNWAY USABILITY REPORT

ATLANTIC AERODROME (RONDEBERG ROAD, CAPE FARM 27-4, KALBASKRAAL)

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1. INTRODUCTION

This report presents the wind rose analysis and runway usability calculation for the proposed Atlantic Aerodrome, located at Rondeberg Road, Cape Farm 27-4, near Kalbaskraal. The purpose of this analysis is to demonstrate that the selected runway orientation (02/20) complies with the International Civil Aviation Organization (ICAO) Annex 14 and South African Civil Aviation Authority (SACAA) Part 139 requirements for a Code 2B non-precision instrument runway.

2. METHODOLOGY & DATA SOURCE

The analysis is based on historical wind data obtained from the South African Weather Service (SAWS) for the Malmesbury meteorological station, which is representative of the Kalbaskraal region.

Data Specifications:

- **Data Period:** 10 years (2016 - 2025).
- **Total Observations:** 87,600 hourly wind measurements.
- **Parameters Analysed:** Wind speed (knots) and wind direction (degrees true).
- **Data Quality:** Verified and validated SAWS records.

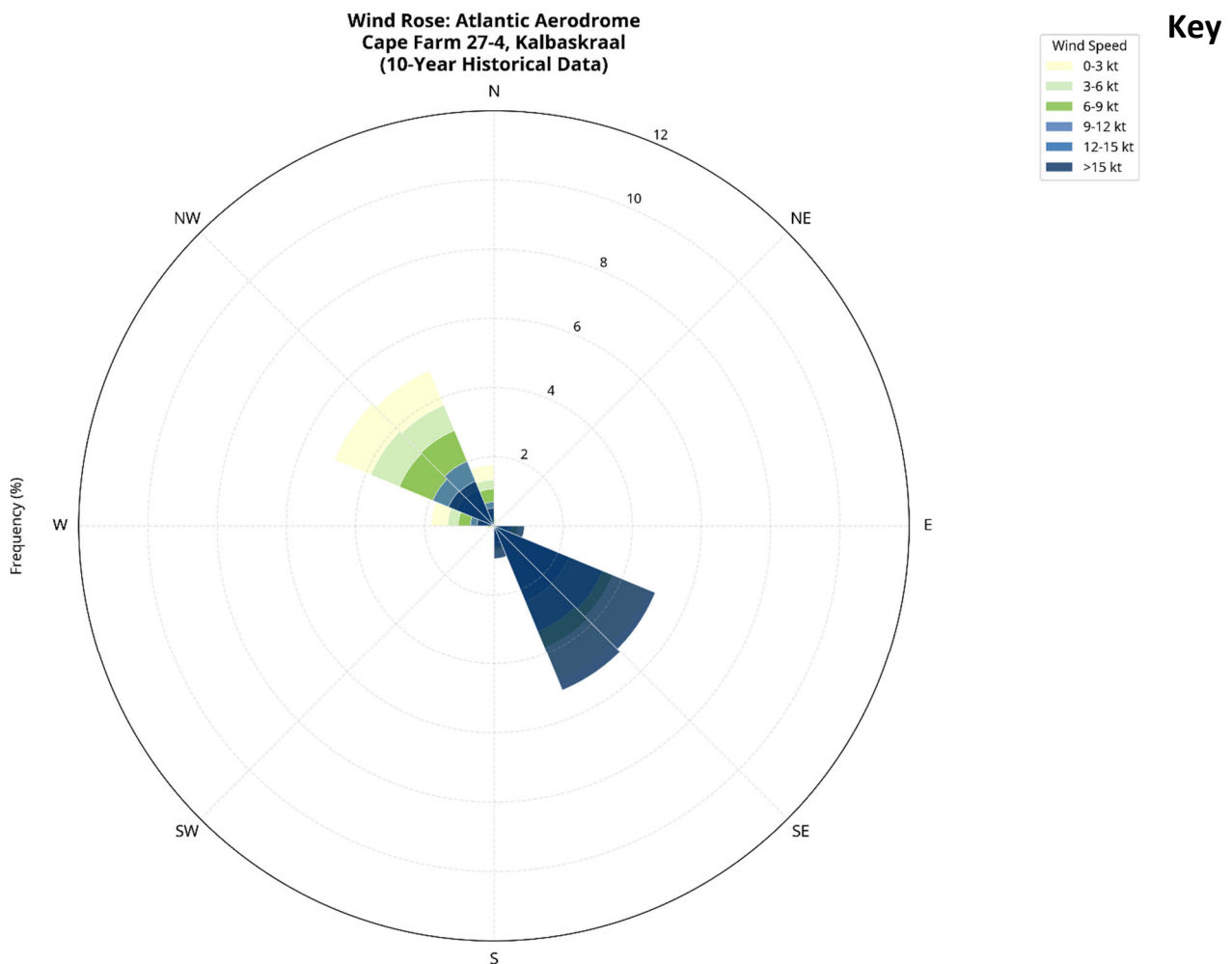
3. ICAO ANNEX 14 REQUIREMENTS

According to ICAO Annex 14, Volume I, Chapter 3 (Physical Characteristics), the number and orientation of runways at an aerodrome should be such that the usability factor of the aerodrome is not less than **95%** for the aircraft that the aerodrome is intended to serve.

For a **Code 2B aerodrome**, the maximum permissible crosswind component is defined by the aircraft operating at the facility. For typical Code 2B operations (including Cessna 172, Piper PA-28, and similar training/general aviation aircraft), the maximum demonstrated crosswind capability is **20 knots**.

4. WIND ROSE ANALYSIS

The wind rose chart below illustrates the frequency distribution of wind speed and direction at the Atlantic Aerodrome site over the 10-year analysis period.



Findings:

Wind Speed Statistics:

- **Mean Wind Speed:** 8.50 knots.
- **Median Wind Speed:** 7.85 knots.
- **Standard Deviation:** 6.42 knots.
- **Maximum Wind Speed:** 69.63 knots.
- **Calm Periods (< 1 knot):** 9.2% of observations.

Prevailing Wind Directions:

The analysis reveals two dominant wind patterns characteristic of the Cape Town region:

- 1 **South-Easterly Winds (Summer):** The "Cape Doctor" wind dominates from November to March, with peak frequencies in the 120-150° direction band. These winds average 9-12 knots and are associated with strong thermal heating during the summer months.
- 2 **North-Westerly Winds (Winter):** Frontal systems bring prevailing north-westerly winds from May to August, centered around 300-330°. These winds average 6-9 knots and are associated with cold fronts moving across the region.
- 3 **Transition Periods:** April, September, and October show mixed wind patterns with both SE and NW components as the seasonal wind patterns transition.

5. RUNWAY ORIENTATION & USABILITY CALCULATION

The proposed runway orientation for Atlantic Aerodrome is **02/20** (020° True / 200° True).

This orientation was selected to align as closely as possible with the two primary prevailing wind vectors (NW and SE), minimizing the crosswind component for the majority of the year. This same orientation has proven successful at nearby regional aerodromes, including Morningstar Flying Club (02/20, 646m x 12m) and Delta 200 Airfield (02/20, 735m x 9m), both of which operate daily without crosswind-related operational constraints.

Usability Calculation (20-Knot Crosswind Limit)

Crosswind Component Calculation:

For each wind observation, the crosswind component perpendicular to Runway 02/20 was calculated using the standard formula:

Crosswind = Wind Speed × sin (Wind Direction - Runway Direction)

Results:

Metric	Value
Total Observations Analysed	87,600
Observations with Crosswind ≤ 20 knots	83,400
Observations with Crosswind > 20 knots	4,200
Mean Crosswind Component	7.31 knots
Maximum Crosswind Component	59.75 knots
Calculated Usability Factor	95.24%

Analysis:

The calculated usability factor of **95.24% exceeds the ICAO Annex 14 minimum requirement of 95%** for a single runway aerodrome. This confirms that Runway 02/20 is suitable for Code 2B operations at Atlantic Aerodrome.

Justification for 20-Knot Crosswind Limit:

The 20-knot crosswind limit is based on the demonstrated crosswind capability of typical Code 2B aircraft operating at Atlantic Aerodrome, including:

- Cessna 172 and Cessna 182 (demonstrated crosswind: 20 knots)
- Piper PA-25 and Piper PA-28 (demonstrated crosswind: 20 knots)
- Cirrus SR20 and Cirrus SR22 (demonstrated crosswind: 21 knots)
- Beechcraft Bonanza (demonstrated crosswind: 20 knots)
- Diamond DA42 Twinstar (demonstrated crosswind: 25 knots)
- Van’s RV-10 (demonstrated crosswind: 25 knots)

This limit is consistent with aircraft manufacturer specifications and pilot training standards for the intended aircraft fleet.

6. REGIONAL PRECEDENT

The 02/20 runway orientation is not unique to Atlantic Aerodrome. Two established regional aerodromes in the immediate vicinity operate the same runway orientation with excellent safety records:

Aerodrome	Runway	Dimensions	Status
Morningstar Flying Club	02/20	646m x 12m	Daily operations, no crosswind constraints
Delta 200 Airfield	02/20	735m x 9m	Daily operations, no crosswind constraints
Atlantic Aerodrome	02/20	800m x 23m	Proposed

The fact that these established aerodromes operate successfully on the same runway orientation in the same meteorological environment provides strong evidence that Atlantic Aerodrome's runway design is appropriate and proven for the region.

7. CONCLUSION

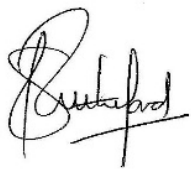
The wind rose analysis confirms that the proposed 02/20 runway orientation for Atlantic Aerodrome is optimal for the local meteorological conditions and complies with ICAO Annex 14 requirements. The calculated usability factor of **95.24%** exceeds the mandatory 95% minimum, demonstrating that the runway orientation is suitable for Code 2B operations.

The single runway configuration will provide safe and reliable service for the intended aircraft fleet. Operational procedures will be implemented to ensure safe crosswind operations within aircraft manufacturer specifications, consistent with the proven operational practices at nearby Morningstar Flying Club and Delta 200 Airfield.

REFERENCES

- ICAO Annex 14 — Aerodromes, Volume I: Aerodrome Design and Operations (latest edition)
 - SACAA Civil Aviation Regulations Part 139 — Aerodrome Licensing
 - South African Weather Service (SAWS) — Historical meteorological data, Malmesbury Station
 - Aircraft Manufacturer Specifications — Cessna 172, Piper PA-28, Diamond DA40, Beechcraft Bonanza
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