APPENDIX 21

VISUALIZATION OF FACT AND FAWN COMBINED OPERATIONS

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NLR-CR-2023-365 | October 2023

Visualization of FACT and FAWN combined operations

CUSTOMER: NACO

Royal NLR - Netherlands Aerospace Centre

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1 Visualization of FACT and FAWN combined operations

1.1 Introduction

This document is an overview and explanation of a developed Fast-Time simulation AirTOp model for Cape Town international airport (FACT) and Cape Winelands Airport (FAWN). This model has been developed by NLR, under contract of NACO. The model has been developed to create 2 visualizations (i.e. video animations) that should highlight how the traffic flows to and from both airports could look like, and to visualize where are the critical points in the traffic flows in terms of for example crossing traffic flows. These visualizations can be used in further discussions in the airport development project.

The AirTOp model remains property of NLR, however, the outputs/results coming from the model will be delivered to NACO. These results should only be interpreted considering the explanations in this document. NLR does not assume responsibility for any of the delivered inputs; the assumptions that needed to be made for this model were not verified with the local authorities, but are based upon expert judgment from NLR.

The model used for the visualisation used a combination of 4 traffic samples, for each runway combination (i.e. FACT 01 simultaneous in use with FAWN NEW_01 and FACT 19 simultaneous in use with FAWN NEW_19):

- Runway 01:
  - FAWN: Opening year IFR NEW_01
  - FACT: Average day on runway 01 from 2019 (here 12-08-2019 is used)
- Runway 19:
  - FAWN: Opening year IFR NEW_19
  - FACT: Average day on runway 19 from 2019 (here 22-06-2019 is used)

1.2 Disclaimer

The visualizations are based on the work documented in “CWA – Airspace CONPOPS Report 20221013 FINAL V1.0”. It must be noted that this document is intended as a starting point for the discussions between the relevant stakeholders (e.g. ANSP, aviation authorities, aerodromes, operators, adjacent landowners, etc.). The presented CONOPS is not the final solution and requires further development and interactions with the relevant stakeholders.

1.3 Inputs

The following inputs were used to develop the AirTOp model:

- Traffic sample for FAWN as delivered by NACO on September 6th 2023 (CWA_Traffic Samples_Noise study_v3.0.xlsx)
- Tower log for FACT as delivered by NACO on August 3rd 2023 (FACT 2019 tower.xslx)

- Sketches of potential route concepts as developed by NLR in a previous study (CWA – Airspace CONOPS report FINAL v1.0.pptx)
- AIP data as shared with NLR during the airspace assessment (previous bullet)
- Threshold coordinates as delivered by NACO on August 29th 2023

1.4 Assumptions and limitations

Assumptions made in AirT0p for the visualisation of the combination of traffic flows to/from FACT and FAWN, as well as some limitations of the developed model:

- Traffic for FACT is based upon an average day for each runway as per the traffic sample, modelling only the scheduled IFR traffic
    - Helicopter, VFR, military, non-scheduled and other traffic are not considered in the visualisation
- Standard separation has been used in all TMA of 5NM lateral and 1000ft vertical
- (Conservative) 5NM separation for traffic on final approach
- Existing RNP procedures for FACT 01/19 have been used in the model
- Existing SID and STAR procedures for FACT have been used in the model
- Departures have a 2 minute time based separation
- Departures don't take off if an aircraft on final is within 4NM of threshold
- Only the runway has been modelled, no ground operations (runway entry/exits, taxiways, parking bays,…) are included in the visualisation. By nature of the software, this leads to departing aircraft appearing already on the runway while in reality they would be at the line-up point behind a stop bar.
- The same colour codes are used from previously made studies (e.g. green tracks for FAWN arrivals)
- Flight procedures for FAWN are based upon previously made studies
    - Differences are modelled for departing traffic, they turn east bound earlier then in the PANS-OPS (conservative) based previous study
    - Difference is also made for ERDAS TMA entries going to FAWN. In the current visualisation these flows are split from FACT traffic immediately after TMA entry, where as in the previous study there were only split a few miles after TMA entry.

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NLR has been a centre of expertise for over a century now, with a deep-seated desire to keep innovating. It is an organisation that works to achieve sustainable, safe, efficient and effective aerospace operations.
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From its main offices in Amsterdam and Marknesse plus two satellite offices, NLR helps to create a safe and sustainable society. It works with partners on numerous programmes in both civil aviation and defence, including work on complex composite structures for commercial aircraft and on goal-oriented use of the F-35 fighter. Additionally, NLR helps to achieve both Dutch and European goals and climate objectives in line with the Luchtvaartnota (Aviation Policy Document), the European Green Deal and Flightpath 2050, and by participating in programs such as Clean Sky and SESAR.

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CWA Fast Time Simulation Summary

1. Introduction

The document titled "NLR-CR-2023-365" created by the Netherlands Aerospace Centre (NLR) for NACO, presents a Fast-Time Simulation (FTS) model developed to visualize combined operations between Cape Town International Airport (FACT) and Cape Winelands Airport (FAWN). The purpose of the simulation is to illustrate traffic flows between the two airports and identify critical points where conflicts may arise. This tool is intended to facilitate further discussions among stakeholders regarding the airport development project.

Key highlights of the document:

- The simulation model used real traffic data from 2019 for FACT and hypothetical traffic data for FAWN's opening year.
- It visualizes operations for two runway combinations (FACT 01/19 and FAWN 01/19). See figures 1 and 2 below.

Figure 1: Runway 01 Operations

Figure 2: Runway 19 Operations

- The visualization follows standard separation rules for air traffic (5NM lateral and 1000ft vertical).
- Various assumptions were made, such as focusing only on scheduled IFR traffic and excluding ground operations or non-scheduled traffic.
- The visualizations provide a conservative representation of traffic interactions and are based on prior studies but require further development with local authorities and stakeholders.

The document is primarily meant to initiate discussions and is not a final solution for the airspace design challenges between FACT and FAWN.

2. Objectives

The objective of the visualizations in the fast-time simulations (FTS) includes several key goals:

a. **Traffic Flow Analysis**: To visually represent and analyse the movement of aircraft within the airspace, helping to identify patterns, bottlenecks, and areas for

improvement.

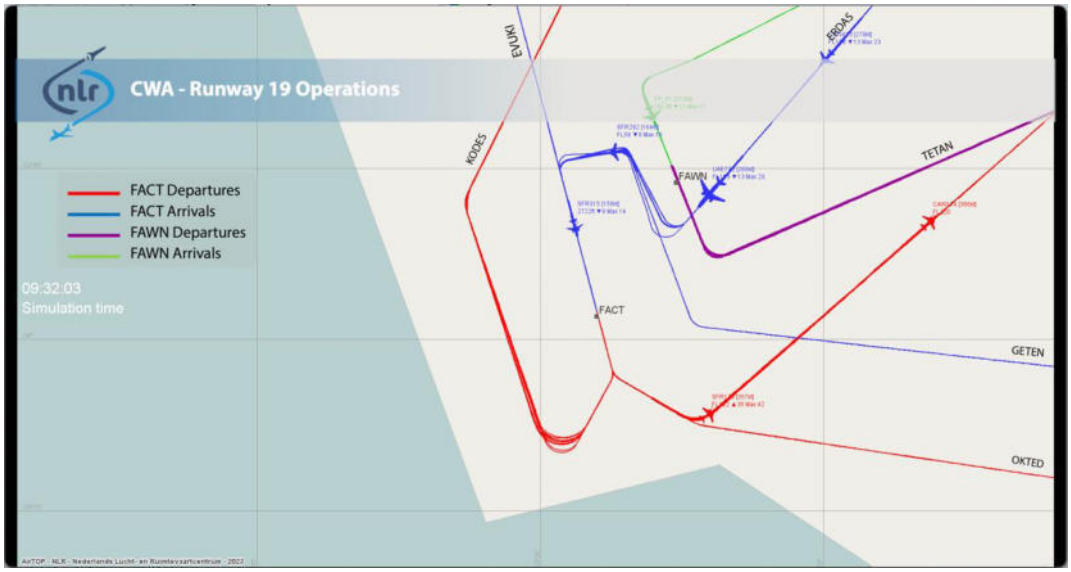

Figure 3: Traffic Flow Analysis

b. **Conflict Detection**: To display potential conflicts between flight paths, allowing for the assessment of separation standards and the effectiveness of proposed procedures. Figure 4 below shows vertical separation of ~9000 feet between the aircraft landing at CWA and the arrival for Cape Town passing overhead CWA.

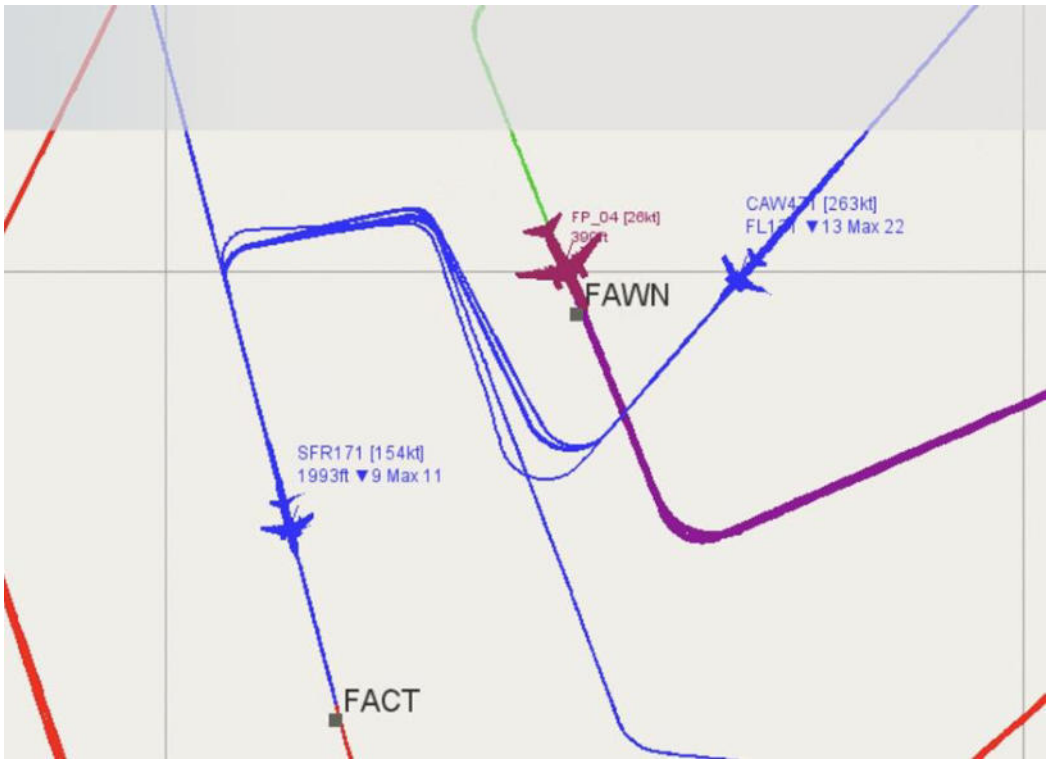

Figure 4: Conflict Detection

c. **Scenario Comparison**: To facilitate the comparison of different operational scenarios or procedures, demonstrating the impacts of changes in air traffic management, routing, or airport operations. See figure 5 below.

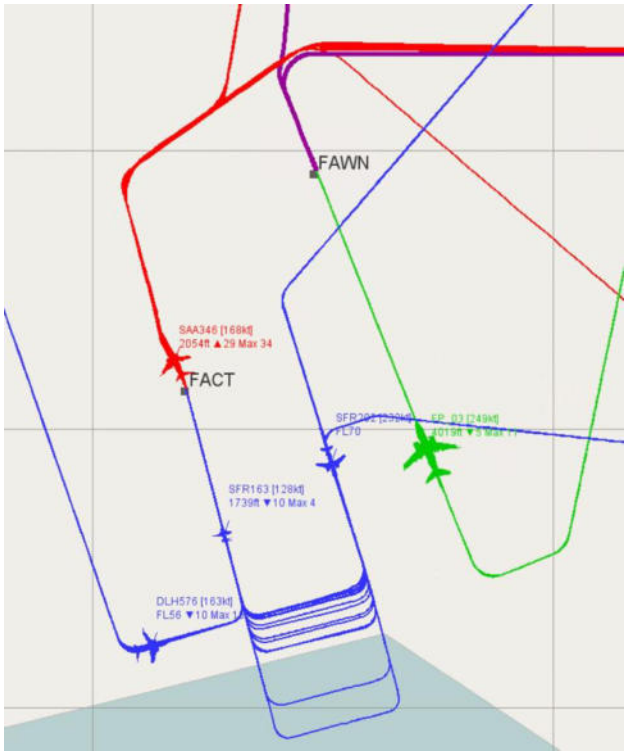

Figure 5: Scenario Comparison: Arrivals at CTIA and CWA

d. **Stakeholder Communication**: To provide clear and accessible representations of complex data for stakeholders, making it easier to communicate findings and recommendations to non-technical audiences.

e. **Decision Support**: To aid decision-making processes by providing visual evidence to support proposed changes or investments in infrastructure and operational practices.

By focusing on these objectives, the visualizations serve as essential tools for understanding the results of the fast-time simulations and guiding future air traffic management strategies.

3. Key Findings

- Traffic Patterns: The traffic patterns observed, including peak times, did not reveal any delays, or bottlenecks. It shows that the similar standard instrument departure (SID) and Standard Terminal Arrival Route (STAR) structures proposed for CWA will seamlessly integrate with existing SIDs and STARs in the Cape Town Terminal Area. The virtually "parallel" routes will contribute to avoiding capacity restrictions at the airports.
- Capacity Assessment: No capacity constraints were identified
- Conflict Resolution: Based on the parallel approaches to and from the airport, conflicts are avoided.

4. Implications for Stakeholders

The fast time simulation supports the specialist studies that capacity will not be affected and will not impact by neighboring airports.