Prepared by:

[redacted]

Unmarked

Edinburgh Simulator Validation Report

Version 2.1 – 20 July 2018

Table of Contents

1. Introduction 4

2. Overview 5

3. Aircraft Types 6

3.1. Session 9 7

3.2. Sessions 10-11 8

4. Conditions 9

4.1. Wind Direction 9

4.2. Wind Speed 10

4.3. Surface Temperature 11

4.4. Atmospheric Pressure 12

5. Flight Simulator Objectives 13

5.1. Overall Objectives 13

5.2. Considerations 13

5.3. Conditions 13

5.4. Screenshots 13

5.5. Output 13

5.6. Simulator Runs 14

6. Procedures 16

6.1. Route A (ACP Route A6 – ARBOR – EVTOL 1C) 16

6.2. Route A2 (ACP Route A3 – ACORN – ARLER 1C) 18

6.3. Route B1 (ACP Route B5 – BRIER – MAVIX 1C) 20

6.4. Route B2 (ACP Route B2 – BEECH – LIKLA 1C) 22

6.5. Route C (ACP Route C5 – CEDAR – GRICE 4C) 24

6.6. Route D Option 1 (ACP Route D0 – DOWEL – VOSNE 1C) 26

6.7. Route D Option 2 (Consultation Route D3) 28

6.8. Route E Option 1 (Consultation Route E6) 30

6.9. Route E Option 2 (ACP Route E7 – ELDER – EMJEE 1D) 33

6.10. Route F Option 1 (Consultation Route F2) 39

6.11. Route F Option 2 (ACP Route F2a – FLORA – GRICE 5D) 41
6.12. Route G (ACP Route G5 – DOWEL – VOSNE 1D) 44
6.13. Route H1 (ACP Route H2 – HEATH – KRAGY 1D) 49
6.14. Route H2 (Consultation Route Hw) 52
6.15. Route E Option 3 56
6.16. Route E Option 4 59
6.17. FAULD 1A (EDIBO 1B - EDIBO 1D) and ILS or RNAV(GNSS) Approach to Runway 06 61
6.18. FIRTH 1A (EDIBO 1A – EDIBO 1C) and ILS or RNAV(GNSS) Approach to Runway 24 66
6.19. EMJEE 1U 70
6.20. EMJEE 1V 73
6.21. EMJEE 1W 75
6.22. EMJEE 1X 77
6.23. EMJEE 1Y 79
6.24. EMJEE 1Z 81
6.25. KRAGY 1U 83
6.26. KRAGY 1V 85
6.27. KRAGY 1W 87
6.28. KRAGY 1X 89
6.29. KRAGY 1Y 91
6.30. KRAGY 1Z 93
7. Conclusions 95

1. Introduction

The Edinburgh Airspace Change Proposal will upgrade the arrival and departure procedures at Edinburgh Airport to take advantage of the improved navigational capabilities of RNAV and improve the efficiency and capacity of the airspace around Edinburgh Airport. The CAA requires that flight or simulator validation takes place to demonstrate the flyability of new procedures before they are approved for publication in the AIP. This document provides the results of the simulator validation activities

The initial simulator validation activities were conducted on four aircraft types representing the range of aircraft typically operating from Edinburgh Airport. They were conducted between 05 May 2017 and 02 June 2017. While largely successful there were a couple of issues related to speed restrictions and waypoint sequencing on A320 aircraft.

An additional simulator validation session in an A320 was conducted on 13 October 2017 to try and resolve these issues. This session also tested a new “Route A2” which approximates the current conventional TLA departure. This session validated all outstanding procedures although the Transition to ILS approach sequences required manual intervention from the pilots.

Following discussions with the CAA in December, the departures from runway 06 had to be redesigned to prevent aircraft from turning before the DER. Two final simulator validation sessions in an A320 and a B737 were conducted on 12 February 2018 and 23 February 2018. These sessions validated the new SID designs and the sequencing from Transition to ILS approach.

2. Overview

In the UK, the requirement for flight/simulator validation is identified as part of the CAP785 approval process. The means of conducting flight/simulator validation is detailed in the CAA Policy Statement "Validation of Instrument Flight Procedures" and compliance to this policy is the responsibility of the sponsor.

The options available to assess the flyability of the draft designs are:

A. Actual flight of an aircraft on the procedures. (e.g. DA42 flies procedures.)
B. Full-motion or fixed-base simulator. (e.g. Suitably qualified pilot flies procedures in A318 simulator.)
C. PC 'Monte Carlo' flight simulation. (e.g. NATS analysts perform runs on PC Desktop tool)

Option A was not chosen on the basis that obstacle verification is not required, and that there is no other known benefit by physically flying these procedures compared to a simulation.

Option B was chosen in order to test:

- Flight Management System (FMS) performance – how well do a variety of FMSs handle the procedures?
- Aircraft performance – how manageable are the procedures for a variety of aircraft?
- Integrity of RNAV coding – assurance that the proposed procedure coding works in all feasible wind conditions without FMS errors (such as disconnect).
- Cockpit workload – how easy/difficult are the procedures to manage?

Option C was not chosen on the basis that the available tools have not yet been accepted by the CAA for the purpose of flyability assessments. Desktop simulation is in the early stages of development and until such time as it is accepted for flyability assessment, the evidence will be provided solely by Option B.

3. Aircraft Types

Aircraft departure figures have been taken from the Electronic Flight Progress Strip (EFPS) data covering the period from 31 August 2015 to 13 March 2016. The top 20 aircraft types are listed below.

Type	Manufacturer	Name	Number	Percentage
DH8D	Bombardier	Dash 8 Q400	4279	15.90%
B738	Boeing	737-800	4120	15.31%
A319	Airbus	A319	4109	15.27%
A320	Airbus	A320	3863	14.35%
E190	Embraer	Embraer 190	2197	8.16%
B733	Boeing	737-300	1138	4.23%
SF34	Saab	340 (Saab)	1029	3.82%
AT76	ATR	Alenia ATR-72-600	842	3.13%
D328	Fairchild-Dornier	328 (Dornier)	733	2.72%
E170	Embraer	Embraer 170	635	2.36%
B752	Boeing	757-200	456	1.69%
B763	Boeing	767-300ER	449	1.67%
A321	Airbus	A321	443	1.65%
RJ1H	BAE Systems	Avro RJ-100 Avroliner	301	1.12%
B788	Boeing	787-8	183	0.68%
A332	Airbus	A330-200	152	0.56%
B737	Boeing	737-700	140	0.52%
SH36	Short	SD3-360	118	0.44%
BE20	Hawker Beechcraft	King Air 200	109	0.41%
F70	Fokker	70 (Fokker)	101	0.38%

Table 1: Top 20 Aircraft Types (by Volume) at Edinburgh Airport

Based on the performance characteristics of these aircraft types we selected the following aircraft types for simulator validation:

Airbus A320

- Covers A319, A320, and A321 aircraft types
- Covers 31% of aircraft movements
- This type has previously been identified (EGKK “Route 4”) as being negatively affected by certain RNAV SID design configurations and weather conditions (i.e. crosswind to tailwind conditions in first turn on ‘wrap around’ SID designs)
- Primary operator: easyJet

Boeing 737-800

- Covers B733, B734, B736, B737, B738, and B739 aircraft types
- Covers 21% of aircraft movements
- This type has previously been identified (during TUTUR SID route trial at EGPH) as being negatively affected by certain RNAV SID design configurations and high climb gradients which it can achieve (the B787-8 was also similarly affected and therefore this type is seen as covering the lateral deviation/discontinuity error)
- Primary operator: Ryanair

Bombardier Dash 8 Q400

- Covers 16% of aircraft movements
- Turbo-prop with significantly different performance characteristics to the jet types
- Primary operator: Flybe

Boeing 767-300ER

- Covers B762, B763, and B788 aircraft types
- Covers 3% of aircraft movements
- This represents the Heavy aircraft operating from Edinburgh
- Primary operator: British Airways

Using past performance, including the TUTUR SID trial, we believe that the Embraer E170 and E190 have similar performance characteristics to the Boeing 737 (though were NOT affected by discontinuity errors) so could be considered to be covered by that aircraft type.

Conducting flight simulator validation using these four typical aircraft types/performance groups covers approximately 80% of the aircraft operating at Edinburgh Airport.

While the Saab 340 or ATR-72-600 (primary operators: Loganair and Stobart Air); covering AT76, D328, and SF34 aircraft types (equal to 10% of current aircraft movements) could be used to represent the turboprop aircraft with a low rate of climb (excluding the, now relatively rare, Shorts 360), this type/group has been excluded as the climb profiles required on the non-jet SID design options will be no steeper than current conventional non-jet SIDs at EGPH.

Separate radar data based analysis was completed in order to determine the specific climb performance required to replicate (or improve where possible) the current (conventional SID) lateral track avoidance of Cramond (for Runway 06 departures). This indicated that most aircraft departing from runway 06 reached 500ft AAL before they crossed the DER and those that didn't tended to be low-performing turboprop aircraft.

3.1. Session 9

The initial simulator validation activities (Sessions 1-8) identified some issues sequencing from the RNAV Arrival Transitions to the ILS Approaches as well as some issues with the runway 06 departures that were specific to the A320 aircraft type. There was also a decision made following the public consultation to design an additional departure from runway 24 to TLA that approximates the current conventional SID. An additional simulator validation session was therefore held using an A320 aircraft to investigate the issues raised during the initial simulator validation sessions and test the new departure procedure.

3.2. Sessions 10-11

Following a meeting with the CAA in December, NATS was asked to redesign the departures from runway 06 to prevent aircraft from turning before the DER. This required a change to the coding of the initial departure legs and these procedures therefore required further simulator validation. Several departure options were designed and these were tested in two final simulator validation sessions in an A320 and a B737.

4. Conditions

The following data has been obtained from the Iowa Environmental Mesonet which collects and stores environmental data from cooperating members with observing networks. This data includes historical METARs for Edinburgh dating back to 22 August 2011. The full archive of data from 22 August 2011 to 22 December 2016 was downloaded including the Surface Temperature, Wind Direction, Wind Speed, Atmospheric Pressure, and Wind Gust Speed. This data has been analysed to provide an understanding context of the chosen environmental variables.

4.1. Wind Direction

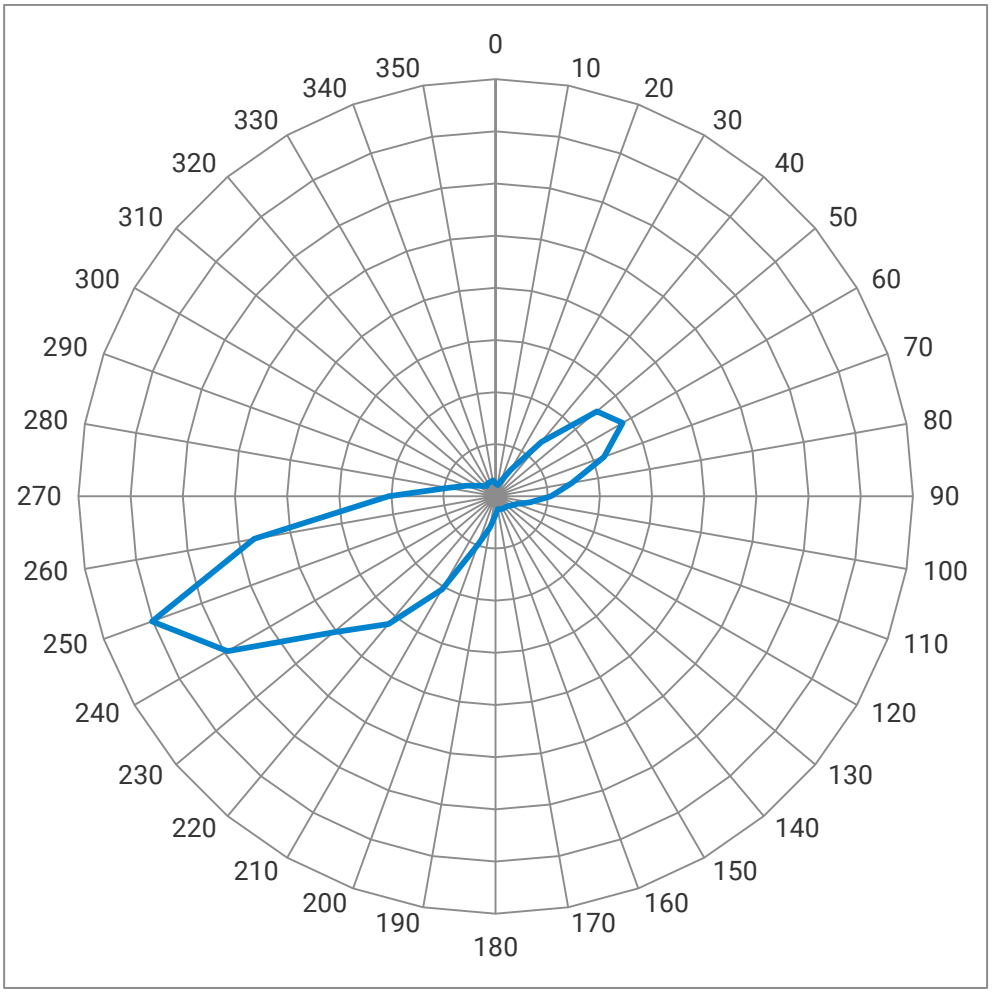


Figure 1: Wind Direction

The predominant wind direction is clearly the W-SW with the most common wind direction being 250. For the purposes of testing the procedures in the most extreme conditions we have considered both headwind and crosswind / tailwind scenarios. For “worst case” climb conditions we have chosen to use a direct crosswind in order to eliminate any headwind component on the initial climb. For “best case” climb conditions we have chosen to use a wind direction that is the average headwind for the first few legs of the procedure.

Wind direction changes with altitude and in the northern hemisphere the wind typically “veers” or rotates in a clockwise direction as altitude increases. This change in wind direction is typically modelled automatically by the flight simulator. If the simulator did not have a default model then a change of +10° per 1000ft was used.

4.2. Wind Speed

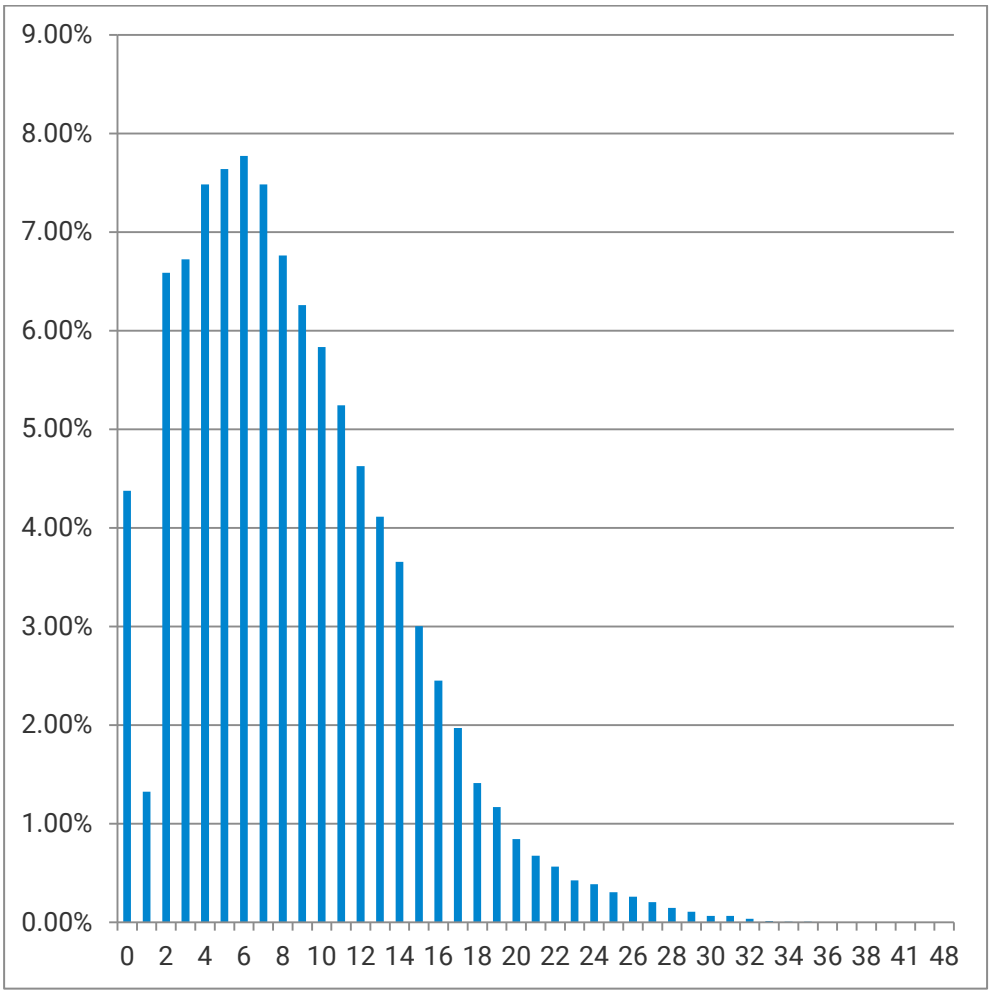


Figure 2: Wind Speed (kts)

As can be seen from Figure 2, winds rarely go above 30kts with wind speeds averaging 8.5kts over this period. For the purposes of testing the procedures in the most extreme conditions we have used a maximum wind speed of 30kts. For “worst case” climb conditions we have therefore used 30kts for the crosswind. For “best case” climb conditions we have used 30kts for the average headwind.

Wind speed increases with altitude and this is typically modelled automatically by the flight simulator. If the simulator did not have a default model then the ICAO wind gradient of +2kt per 1000ft was used.

If the wind speed specified in a specific scenario caused headwind or crosswind components to be outside the aircraft type’s operating envelope then the wind speed was reduced until the headwind and crosswind components were inside the operating envelope.

4.3. Surface Temperature

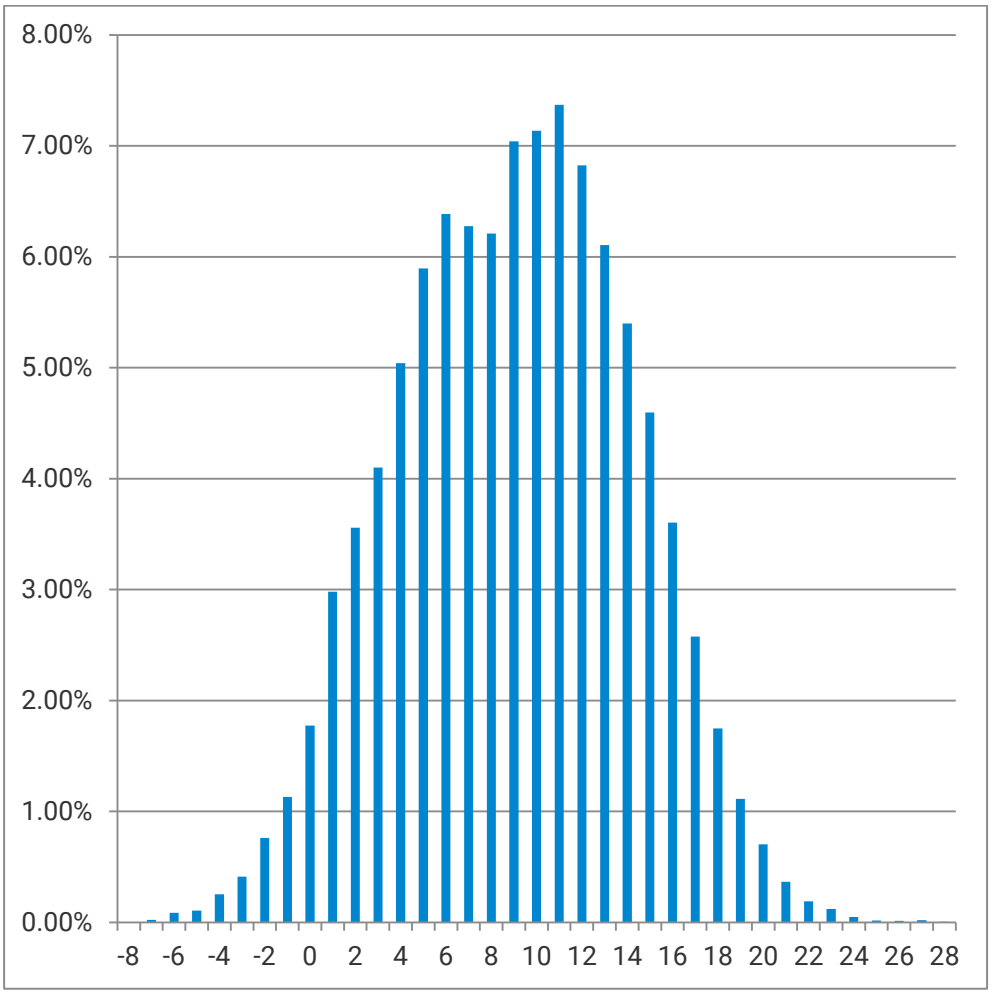


Figure 3: Surface Temperature (°C)

As can be seen from Figure 3, the surface temperature rarely goes below -5°C or above 25°C with an average temperature of 9°C. For the purposes of testing the procedures in the most extreme conditions we have used a minimum temperature of -5°C and a maximum temperature of 25°C. Although the average temperature is 9°C we have used the International Standard Atmosphere (ISA) temperature at mean sea level (MSL) of 15°C for the “base case” scenarios.

Temperature decreases with altitude according to the lapse rate and this is typically modelled by the flight simulator. If the simulator did not have a default model then then the ISA lapse rate of -1.98°C per 1000ft was used.

4.4. Atmospheric Pressure

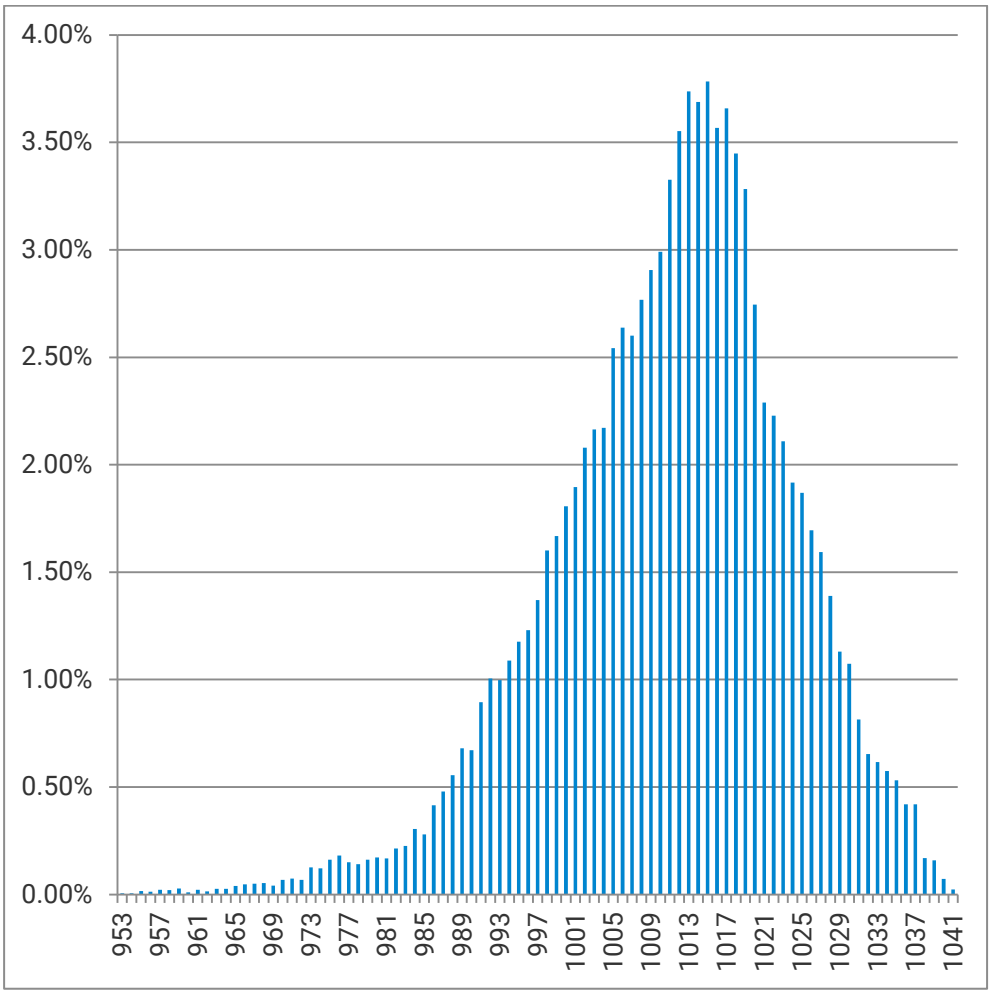


Figure 4: Atmospheric Pressure (hPa)

As can be seen from Figure 4, the atmospheric pressure rarely goes below 960hPa or above 1040hPa with an average pressure of 1011hPa. For “worst case” climb conditions we have used 980hPa as this will reduce climb performance. For “best case” climb conditions we have used 1025hPa as this will increase climb performance.

However, for SIDs which climb to a Flight Level these pressure changes will also have an opposite effect. On a low pressure day the target flight level is actually closer to the ground so the amount of climb is reduced. On a high pressure day the target flight level is actually further from the ground so the amount of climb is increased.

5. Flight Simulator Objectives

5.1. Overall Objectives

Ensure that the procedures being proposed for the Edinburgh Airspace Change Proposal are flyable by the majority of aircraft operating at Edinburgh Airport in the widest range of likely conditions.

5.2. Considerations

During these simulator runs the following were considered:

- FMS performance – how well does a typical FMS handle the procedure?
- Aircraft performance – how manageable are the procedures for typical aircraft?
- Cockpit workload – how easy/difficult is the procedure to manage?

A list of all the environmental conditions to be validated is included in this document.

5.3. Conditions

Specific wind, temperature, pressure, and aircraft weight conditions were specified for each run. Some flight simulators modelled the changing conditions based on altitude. If the simulator did not have a default model then wind direction was configured to increase by 10° for each 1000ft above surface. The wind speed was configured to increase by 2kts for each 1000ft above surface. The temperature was configured to decrease by 1.98°C per 1000ft above surface.

5.4. Screenshots

For most of the runs, a screenshot was taken of the conditions used for the run and/or the track flown by the aircraft. Only those that are particularly relevant have been included in this report however they are all available if required.

The printer connected to the A320 simulator used for sessions 7 and 8 was out-of-service so photographs of the simulator control screen were taken as a substitute. The printer connected to the A320 simulator used for session 9 ran out of toner shortly after the session began but this wasn't discovered until after the session had finished so no screenshots or photographs are available from this session. No screenshots were produced for session 10 in the A320.

At the request of the CAA, for both sessions 10 and 11 video recordings were made of the Primary flight display (PFD) and Multi-function display (MFD). These videos are stored on NATS servers but can be made available on request.

5.5. Output

A data file providing (at a minimum) latitude, longitude, and barometric altitude on a rolling basis (ideally 1 or 4 second intervals) was requested for all simulator runs. This could be in the form of a single file for the entire simulator session or as discrete files for each simulator run. Other parameters that should be included in the data file if possible were:

- Aircraft Heading

- Aircraft Track
- Angle of Bank
- QNH
- IAS
- TAS
- GS
- Wind
- OAT

Data files were received for approximately 50% of the simulator runs as detailed below.

Session	Aircraft Type	Output
Session 1	Bombardier Dash 8 Q400	Full data files are available for all simulator runs. Data was recorded at 0.025 second intervals.
Session 2	Boeing 767-300ER	Full data files are available for approximately half of the simulator runs. Due to the time taken for the simulator to output the data file it was decided to alternate between recorded runs and unrecorded runs. Data was recorded at 1 second intervals.
Session 3	Boeing 737-800	No data files are available as the simulator booked for the simulator validation sessions did not have recording capability.
Session 4	Boeing 737-800	No data files are available as the simulator booked for the simulator validation sessions did not have recording capability.
Session 5	Boeing 767-300ER	Full data files are available for approximately half of the simulator runs. Due to the time taken for the simulator to output the data file it was decided to alternate between recorded runs and unrecorded runs. Data was recorded at 1 second intervals.
Session 6	Bombardier Dash 8 Q400	No data files are available as the file didn't record properly.
Session 7	Airbus A320	Full data files are available for all simulator runs. Data was recorded at 0.1second intervals.
Session 8	Airbus A320	Full data files are available for all simulator runs. Data was recorded at 0.1second intervals.
Session 9	Airbus A320	Full data files are available for all simulator runs. Data was recorded at 0.8333 second intervals.
Session 10	Airbus A320	Full data files are available for all simulator runs. Data was recorded at 1 second intervals.
Session 11	Boeing 737-800	No data files are available as the simulator booked for the simulator validation sessions did not have recording capability.

5.6. Simulator Runs

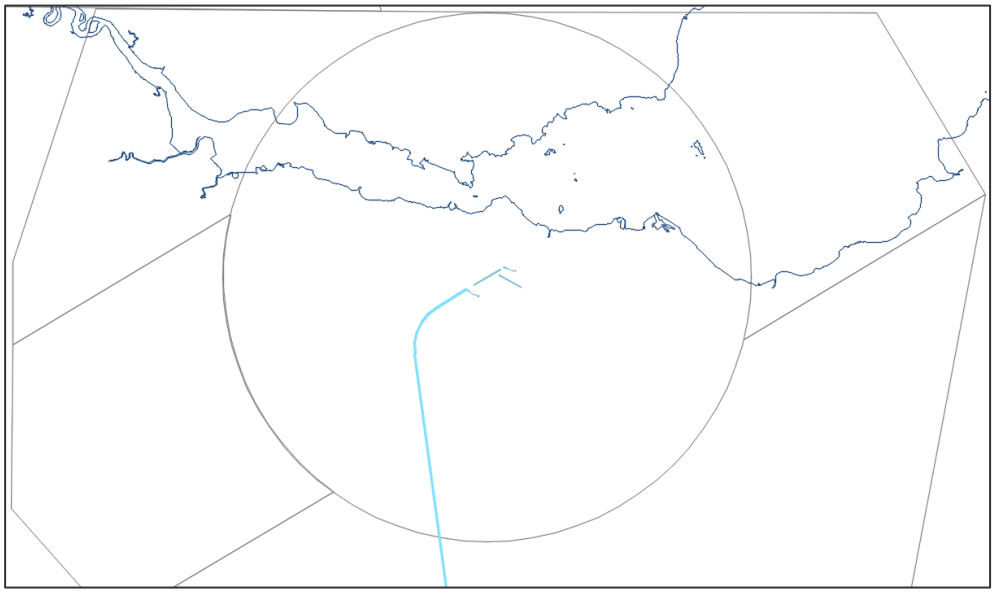
Due to time constraints in the simulators it was not possible to complete all of the simulator runs that had been planned. Out of 196 runs that were planned 150 of them were flown. An additional 10 runs were flown to investigate specific issues identified during the simulator sessions.

For each route there is a table of "Runs Completed" which shows all of the runs that were planned and indicates those that were flown in green and those that weren't flown in amber. The 160 runs

that were completed cover the most adverse conditions for each procedure and give a good base of evidence to support the flyability of these procedures.

6. Procedures

6.1. Route A (ACP Route A6 – ARBOR – EVTOL 1C)



Description:	Replacement for TALLA 6C SID (Non-Jet Only)		
Purpose:	Split eastbound, southbound, and westbound non-jets away from all other aircraft		
Aircraft Types:	AT76, D328, DH8D		
	Scenario 1	**Scenario 2**	**Scenario 3**
Wind Direction:	Still	330°	210°
Wind Speed:	Still	30kts	30kts
Surface Temp:	15°C	25°C	-5°C
Pressure:	1013.2hPa	980hPa	1025hPa
Aircraft Weight:	MTOW	MTOW	Min TOW
Objective:	Base case climb performance	Can level restrictions be met in worst case climb conditions?	Are there any track keeping issues in best case climb conditions?
A320 Run ID:	N/A	N/A	N/A
B738 Run ID:	N/A	N/A	N/A
DH8D Run ID:	A-DH8D-S1	A-DH8D-S2	A-DH8D-S3
B763 Run ID:	N/A	N/A	N/A
Notes:	• Run can terminate after passing penultimate waypoint • Assume climb clearance to FL240		

Runs Completed

	Scenario 1	Scenario 2	Scenario 3
A320 Run ID:	N/A	N/A	N/A
B738 Run ID:	N/A	N/A	N/A
DH8D Run ID:	A-DH8D-S1	A-DH8D-S2	A-DH8D-S3
B763 Run ID:	N/A	N/A	N/A

Results

	Acceptable	Not Acceptable	Deferred
A320:			
B738:			
DH8D:	Acceptable		
B763:			

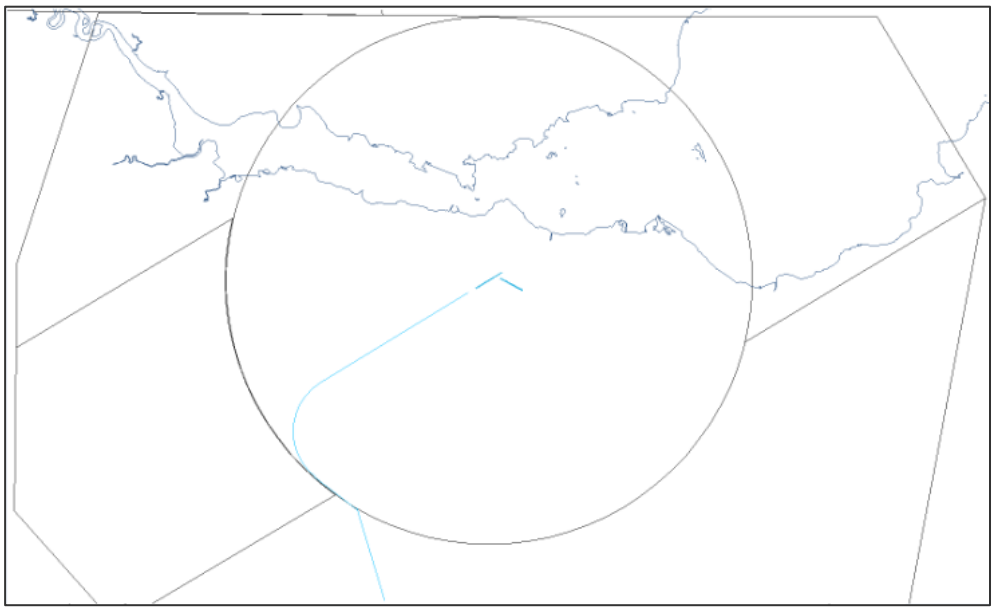
Observations

A320:	
B738:	
DH8D:	None
B763:	

Findings (Sessions 1-8)

No changes are required. This route will be taken forward for inclusion in the ACP.

6.2. Route A2 (ACP Route A3 – ACORN – ARLER 1C)



Description:	Approximation of TALLA 6C SID	
Purpose:	For jet and non-jet departures from R24 to the south via TALLA (turbo-props will use route A6 when it is available).	
Aircraft Types:	A320, A330, AT76, B733, B738, B788, D328, DH8D, E190	
	Scenario 4	**Scenario 5**
Wind Direction:	330°	Still
Wind Speed:	30kts	Still
Surface Temp:	25°C	15°C
Pressure:	980hPa	1013.2hPa
Aircraft Weight:	MTOW	Average
Objective:	Can level restrictions be met in worst case climb conditions?	Average conditions
A320 Run ID:	A2-A320-S4	A2-A320-S5
Notes:	• Assume climb clearance to FL240	

Runs Completed

	Scenario 1	**Scenario 2**
A320 Run ID:	A2-A320-S4	A2-A320-S5

Results

	Acceptable	**Not Acceptable**	**Deferred**
A320:	Acceptable		

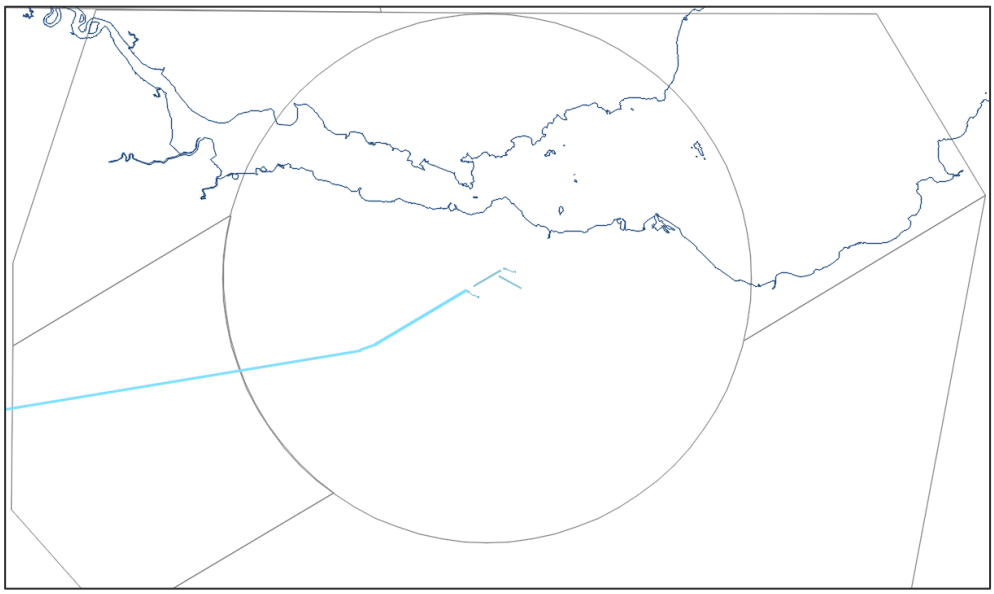
Observations

A320:	No problems

Findings (Session 9)

No changes are required. This route will be taken forward for inclusion in the ACP.

6.3. Route B1 (ACP Route B5 – BRIER – MAVIX 1C)



Description:	Replacement for GOSAM 1C SID (Jet Only)	
Purpose:	Split southbound jets from all other aircraft	
Aircraft Types:	A320, A330, B733, B738, B788, E170, E190	
	Scenario 1	**Scenario 2**
Wind Direction:	Still	150°
Wind Speed:	Still	30kts
Surface Temp:	15°C	25°C
Pressure:	1013.2hPa	980hPa
Aircraft Weight:	MTOW	MTOW
Objective:	Base case climb performance	Can level restrictions be met in worst case climb conditions?
A320 Run ID:	B1-A320-S1	B1-A320-S2
B738 Run ID:	B1-B738-S1	B1-B738-S2
DH8D Run ID:	N/A	N/A
B763 Run ID:	B1-B763-S1	B1-B763-S2
Notes:	• SID must be flown to termination point • Assume climb clearance to FL300	

Runs Completed

	Scenario 1	**Scenario 2**
A320 Run ID:	B1-A320-S1	B1-A320-S2
B738 Run ID:	B1-B738-S1	B1-B738-S2
DH8D Run ID:	N/A	N/A
B763 Run ID:	B1-B763-S1	B1-B763-S2

Results

	Acceptable	Not Acceptable	Deferred
A320:	Acceptable		
B738:	Acceptable		
DH8D:			
B763:	Acceptable		

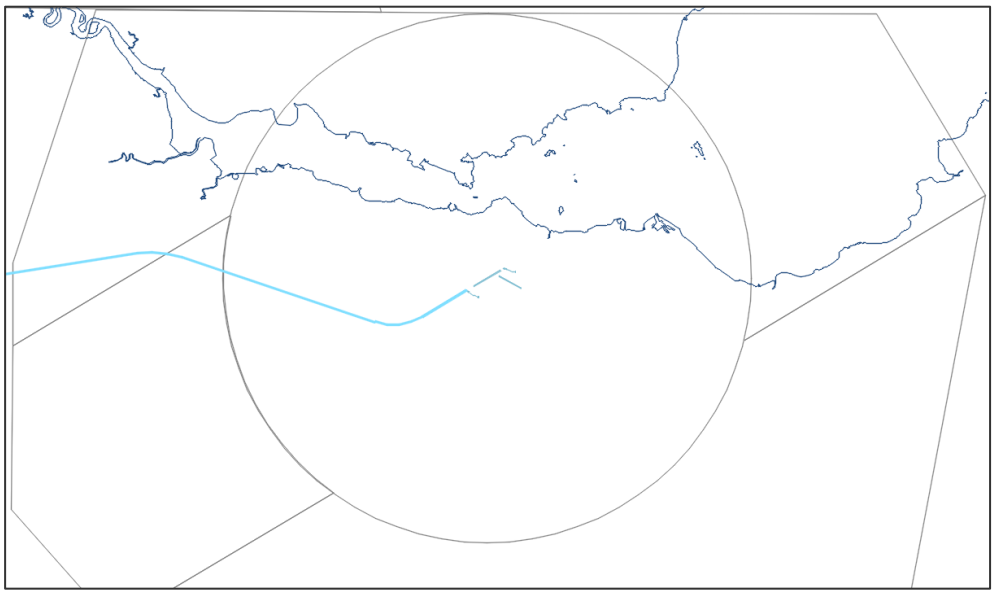
Observations

A320:	None
B738:	Take-off weight not an issue.
DH8D:	
B763:	Nice distance to first waypoint. (Helps if engine failure.)

Findings (Sessions 1-8)

No changes are required. This route will be taken forward for inclusion in the ACP.

6.4. Route B2 (ACP Route B2 – BEECH – LIKLA 1C)



Description:	New SID turning right after Broxburn (Jet Only)		
Purpose:	Split westbound jets from all other aircraft		
Aircraft Types:	A320, A330, B733, B738, B788, E170, E190		
	Scenario 1	**Scenario 2**	**Scenario 3**
Wind Direction:	Still	150°	265°
Wind Speed:	Still	30kts	30kts
Surface Temp:	15°C	25°C	-5°C
Pressure:	1013.2hPa	980hPa	1025hPa
Aircraft Weight:	MTOW	MTOW	Min TOW
Objective:	Base case climb performance	Can level restrictions be met in worst case climb conditions?	Are there any track keeping issues in best case climb conditions?
A320 Run ID:	B2-A320-S1	B2-A320-S2	B2-A320-S3
B738 Run ID:	B2-B738-S1	B2-B738-S2	B2-B738-S3
DH8D Run ID:	N/A	N/A	N/A
B763 Run ID:	B2-B763-S1	B2-B763-S2	B2-B763-S3
Notes:	• SID must be flown to termination point • Assume climb clearance to FL300		

Runs Completed

	Scenario 1	**Scenario 2**	**Scenario 3**
A320 Run ID:	B2-A320-S1	B2-A320-S2	B2-A320-S3
B738 Run ID:	B2-B738-S1	B2-B738-S2	B2-B738-S3
DH8D Run ID:	N/A	N/A	N/A
B763 Run ID:	B2-B763-S1	B2-B763-S2	B2-B763-S3

Results

	Acceptable	Not Acceptable	Deferred
A320:	Acceptable		
B738:	Acceptable		
DH8D:			
B763:	Acceptable		

Observations

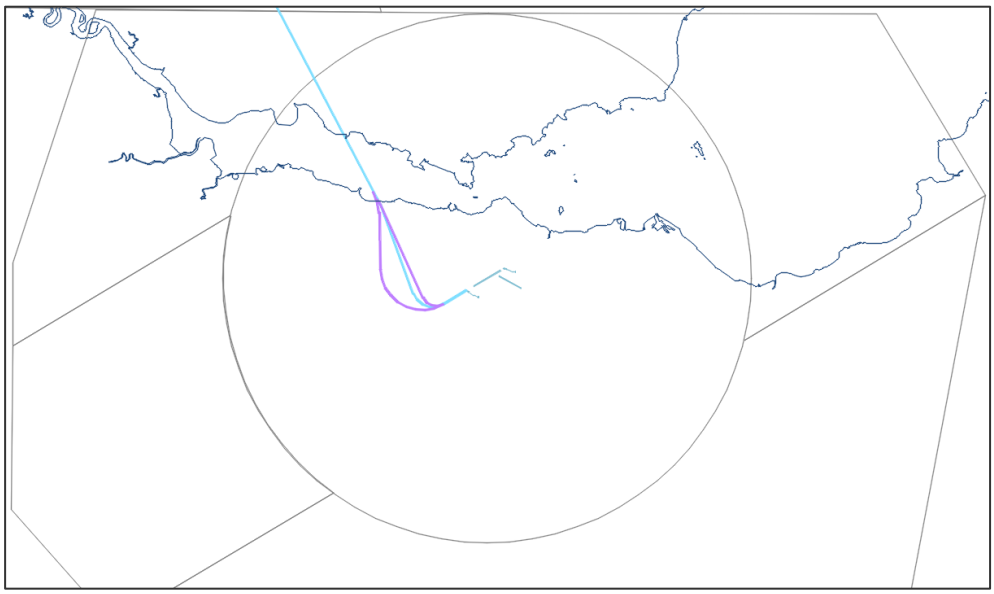
A320:	None
B738:	None
DH8D:	
B763:	No issues

Findings (Sessions 1-8)

Scenario 3 wasn't flown by any aircraft types due to time constraints. However the route is fairly benign and the headwinds in scenario 3 aren't expected to present any significant challenges therefore no changes are required.

This route will be taken forward for inclusion in the ACP.

6.5. Route C (ACP Route C5 – CEDAR – GRICE 4C)



Description:	Replacement for GRICE 3C SID		
Purpose:	Split northbound aircraft from southbound and westbound jets and all other non-jets using an early fly-over waypoint		
Aircraft Types:	A320, A330, B733, B738, B752, B763, B788, D328, SB20, SF34		
	Scenario 1	**Scenario 2**	**Scenario 3**
Wind Direction:	Still	150°	290°
Wind Speed:	Still	30kts	30kts
Surface Temp:	15°C	25°C	-5°C
Pressure:	1013.2hPa	980hPa	1025hPa
Aircraft Weight:	MTOW	MTOW	Min TOW
Objective:	Base case climb performance	Can level restrictions be met in worst case climb conditions?	Are there any track keeping issues in best case climb conditions?
A320 Run ID:	N/A *	C-A320-S2	N/A *
B738 Run ID:	N/A *	C-B738-S2	N/A *
DH8D Run ID:	C-DH8D-S1	C-DH8D-S2	C-DH8D-S3
B763 Run ID:	N/A *	C-B763-S2	N/A *
Notes:	• Run can terminate after passing penultimate waypoint • Assume climb clearance to FL240		

** Jets will test the full fly-over turn for Route D Option 1. For Route C the only test required is that they can meet the Route C level restrictions in the worst case climb conditions.*

Runs Completed

	Scenario 1	Scenario 2	Scenario 3
A320 Run ID:	N/A	C-A320-S2	N/A
B738 Run ID:	N/A	C-B738-S2	N/A
DH8D Run ID:	C-DH8D-S1	C-DH8D-S2	C-DH8D-S3
B763 Run ID:	N/A	C-B763-S2	N/A

Results

	Acceptable	Not Acceptable	Deferred
A320:	Acceptable		
B738:	Acceptable		
DH8D:	Acceptable		
B763:	Acceptable		

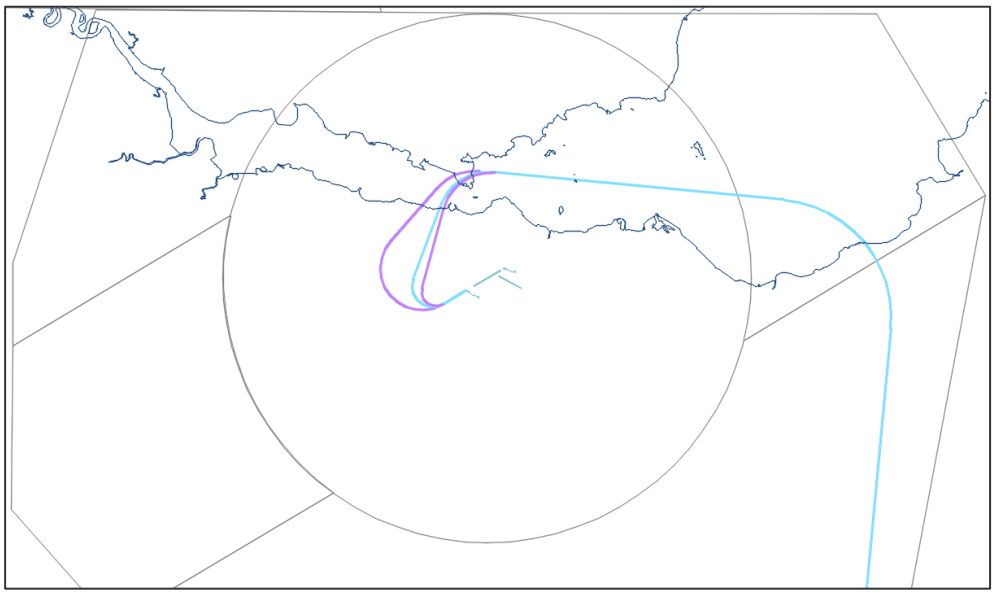
Observations

A320:	None
B738:	None
DH8D:	None
B763:	No issues

Findings (Sessions 1-8)

No changes are required. This route will be taken forward for inclusion in the ACP.

6.6. Route D Option 1 (ACP Route D0 – DOWEL – VOSNE 1C)



Description:	New SID turning right before Broxburn and climbing over the Firth of Forth (Jet Only)		
Purpose:	Remove eastbound jets from TALLA SID and split from southbound and westbound jets and eastbound, southbound, and westbound non-jets using an early fly-over waypoint		
Aircraft Types:	A320, A330, B733, B738, B788, E190		
	Scenario 1	**Scenario 2**	**Scenario 3**
Wind Direction:	Still	150°	290°
Wind Speed:	Still	30kts	30kts
Surface Temp:	15°C	25°C	-5°C
Pressure:	1013.2hPa	980hPa	1025hPa
Aircraft Weight:	MTOW	MTOW	Min TOW
Objective:	Base case climb performance	Can level restrictions be met in worst case climb conditions?	Are there any track keeping issues in best case climb conditions?
A320 Run ID:	D1-A320-S1	D1-A320-S2	D1-A320-S3
B738 Run ID:	D1-B738-S1	D1-B738-S2	D1-B738-S3
DH8D Run ID:	N/A	N/A	N/A
B763 Run ID:	D1-B763-S1	D1-B763-S2	D1-B763-S3
Notes:	• SID must be flown to termination point • Assume climb clearance to FL300		

Runs Completed

	Scenario 1	Scenario 2	Scenario 3
A320 Run ID:	D1-A320-S1	D1-A320-S2	D1-A320-S3
B738 Run ID:	D1-B738-S1	D1-B738-S2	D1-B738-S3
DH8D Run ID:	N/A	N/A	N/A
B763 Run ID:	D1-B763-S1	D1-B763-S2	D1-B763-S3

Results

	Acceptable	Not Acceptable	Deferred
A320:	Acceptable		
B738:	Acceptable		
DH8D:			
B763:	Acceptable		

Observations

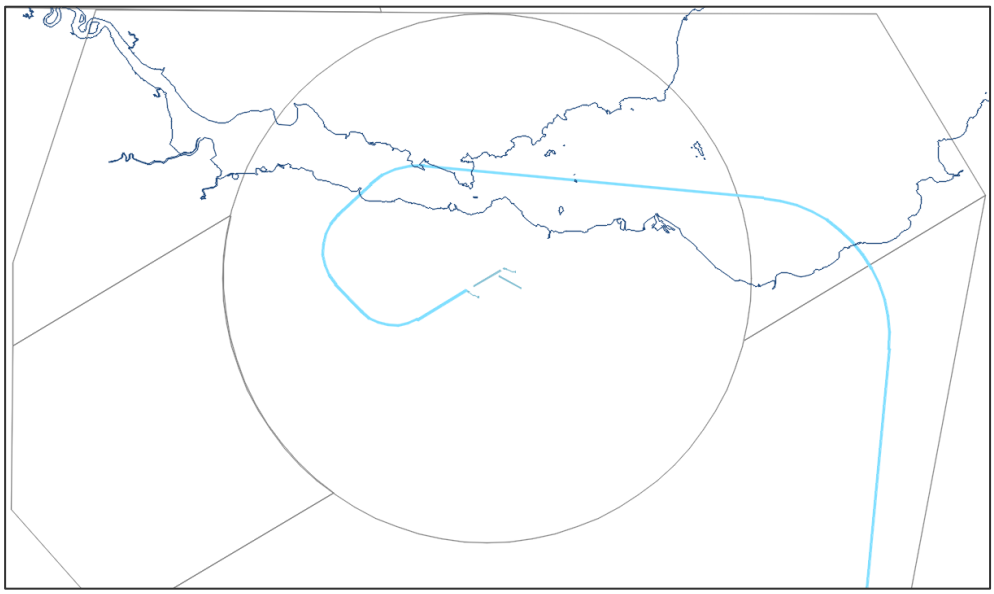
A320:	None
B738:	None
DH8D:	
B763:	No issues

Findings (Sessions 1-8)

Scenario 3 wasn't flown by any aircraft types due to time constraints. However the route has very long legs so the higher altitudes reached with the headwinds in scenario 3 aren't expected to present any significant challenges therefore no changes are required.

This route will be taken forward for inclusion in the ACP.

6.7. Route D Option 2 (Consultation Route D3)



Description:	New SID turning right after Broxburn and climbing over the Firth of Forth (Jet Only)		
Purpose:	Remove eastbound jets from TALLA SID and split from southbound and westbound jets and eastbound, southbound, and westbound non-jets using a fly-by waypoint		
Aircraft Types:	A320, A330, B733, B738, B788, E190		
	Scenario 1	**Scenario 2**	**Scenario 3**
Wind Direction:	Still	150°	290°
Wind Speed:	Still	30kts	30kts
Surface Temp:	15°C	25°C	-5°C
Pressure:	1013.2hPa	980hPa	1025hPa
Aircraft Weight:	MTOW	MTOW	Min TOW
Objective:	Base case climb performance	Can level restrictions be met in worst case climb conditions?	Are there any track keeping issues in best case climb conditions?
A320 Run ID:	D2-A320-S1	D2-A320-S2	D2-A320-S3
B738 Run ID:	D2-B738-S1	D2-B738-S2	D2-B738-S3
DH8D Run ID:	N/A	N/A	N/A
B763 Run ID:	D2-B763-S1	D2-B763-S2	D2-B763-S3
Notes:	• SID must be flown to termination point • Assume climb clearance to FL300		

Runs Completed

	Scenario 1	Scenario 2	Scenario 3
A320 Run ID:	D2-A320-S1	D2-A320-S2	D2-A320-S3
B738 Run ID:	D2-B738-S1	D2-B738-S2	D2-B738-S3
DH8D Run ID:	N/A	N/A	N/A
B763 Run ID:	D2-B763-S1	D2-B763-S2	D2-B763-S3

Results

	Acceptable	Not Acceptable	Deferred
A320:	Acceptable		
B738:	Acceptable		
DH8D:			
B763:	Acceptable		

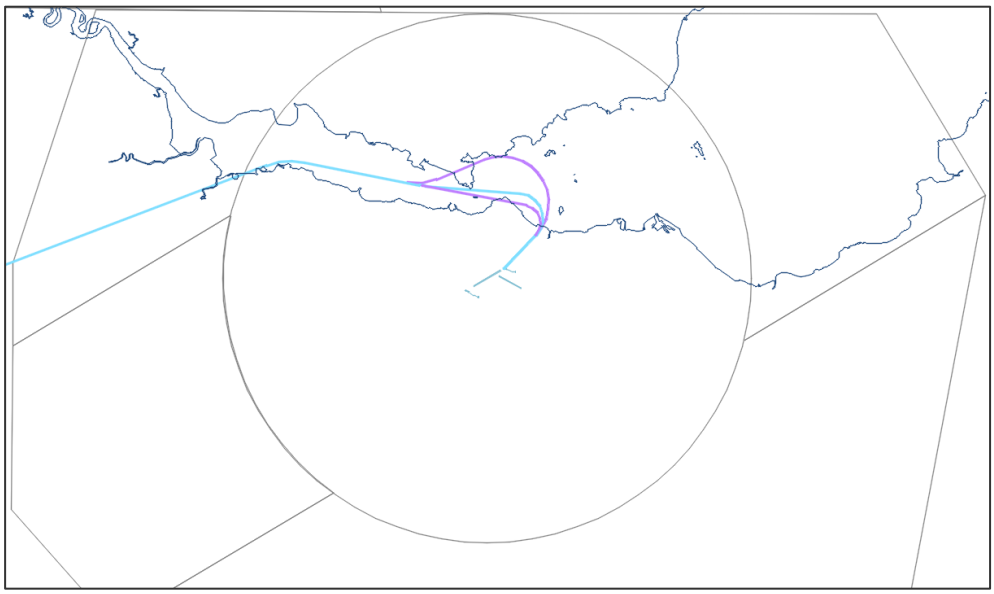
Observations

A320:	None
B738:	The profile flown was acceptable however if the environmental conditions changed there might have been greater deviations off track.
DH8D:	
B763:	No issues

Findings (Sessions 1-8)

No changes are required, however this route is not being taken forward as Option 1 was preferred based on consultation responses.

6.8. Route E Option 1 (Consultation Route E6)



Description:	Replacement for GOSAM 1D SID (Jet Only)		
Purpose:	Split southbound and westbound jets from eastbound jets and eastbound, southbound, and westbound non-jets using an early fly-over waypoint		
Aircraft Types:	A320, A330, B733, B738, B788, E170, E190		
	Scenario 1	**Scenario 2**	**Scenario 3**
Wind Direction:	Still	150°	360°
Wind Speed:	Still	30kts	30kts
Surface Temp:	15°C	25°C	-5°C
Pressure:	1013.2hPa	980hPa	1025hPa
Aircraft Weight:	MTOW	MTOW	Min TOW
Objective:	Base case climb performance	Can level restrictions be met in worst case climb conditions?	Are there any track keeping issues in best case climb conditions?
A320 Run ID:	E1-A320-S1	E1-A320-S2	E1-A320-S3
B738 Run ID:	E1-B738-S1	E1-B738-S2	E1-B738-S3
DH8D Run ID:	N/A	N/A	N/A
B763 Run ID:	E1-B763-S1	E1-B763-S2	E1-B763-S3
Notes:	• SID must be flown to termination point • Assume climb clearance to FL300		

Runs Completed

	Scenario 1	**Scenario 2**	**Scenario 3**
A320 Run ID:	E1-A320-S1	E1-A320-S2	E1-A320-S3
B738 Run ID:	E1-B738-S1	E1-B738-S2	E1-B738-S3
DH8D Run ID:	N/A	N/A	N/A
B763 Run ID:	E1-B763-S1	E1-B763-S2	E1-B763-S3

Results

	Acceptable	Not Acceptable	Deferred
A320:		Not Acceptable	
B738:	Acceptable		
DH8D:			
B763:		Not Acceptable	

Observations

A320:	Aircraft unable to navigate to PHE25 and defaults to next leg. (up to 0.2NM out)
B738:	
DH8D:	
B763:	Late establishment onto CF leg prior to PHE25 (0.2NM out)

Findings (Sessions 1-8)

The A320 and B763 had trouble establishing on the CF leg to PHE25. The data files show that the A320 was between 0.15NM and 0.2NM to the right of the waypoint on runs E1-A320-S1 and E1-A320-S2. Route F Option 1 shares the same initial coding as far as PHE25 and the A320 was approximately 0.2NM to the right of the waypoint on run F1-A320-S2.

The data files show that the B763 was approximately 0.3NM to the right of the waypoint on run E1-B763-S1. While we don't have a data file for run E1-B763-S2, the validation form indicates that the aircraft was approximately 0.2NM off track on that run as well. The screenshots from the B763 do not show any waypoints so it is impossible to judge the track deviation from them.

Unfortunately we didn't have time to fly Scenario 3 in either the A320 or the B763 so all the data that we have relates to Maximum Take-Off Weight aircraft. As expected, the maximum weight aircraft did not achieve 500ft AAL prior to the DER with the A320 reaching 500ft between 0.15NM and 0.25NM beyond the DER. The B763 reached 500ft 0.55NM beyond the DER on run E1-B763-S1.

The B738 had no problem with this procedure and completed all three scenarios. The screenshots from these runs show the aircraft passing directly over PHE25 and then commencing a turn to PHN10. The screenshot from run F1-B738-S2 also shows the aircraft overflying PHE25.

The DH8D did not fly Route E Option 1 but flew the same initial track for Route F Option 1. The data files show that the aircraft was within 0.1NM of PHE25 on both runs.

Figure 5 shows the tracks recorded for the A320, DH8D, and B763 for Route E Option 1 and Route F Option 1. The A320 tracks are in green, the B763 tracks are in red, and the DH8D tracks are in dark blue. The expected average track is in light blue and the expected swathe is in purple. Waypoints and notes are in orange. Figures 6-8 show the screenshots from the B738 runs.

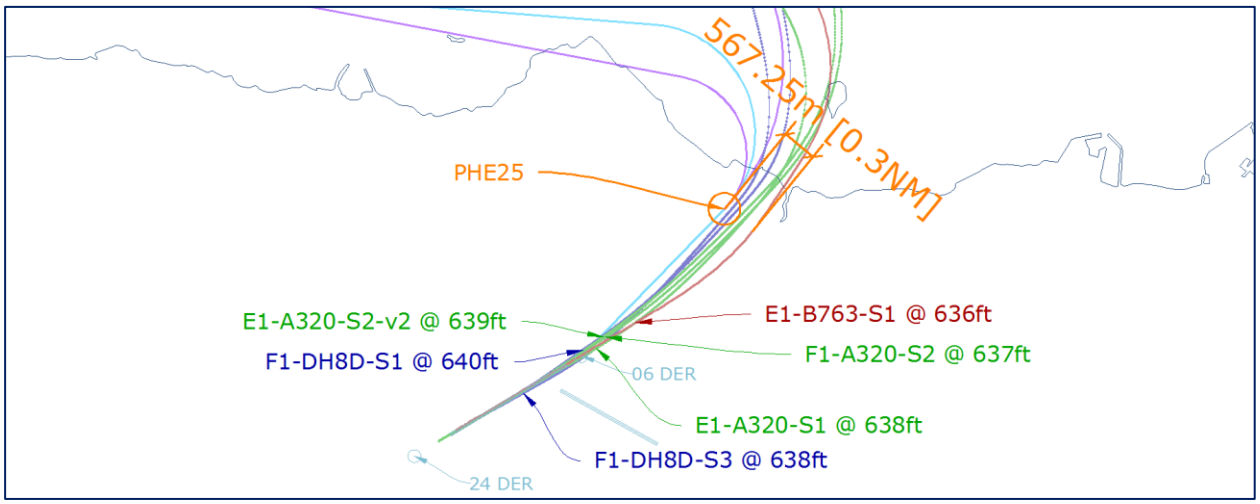


Figure 5: Routes E and F Option 1 Tracks

Figure 6: E1-B738-S1

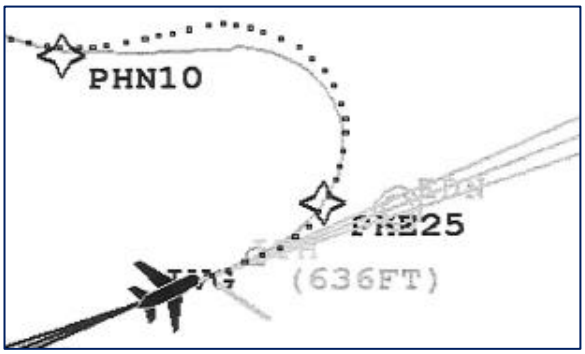


Figure 7: E1-B738-S2

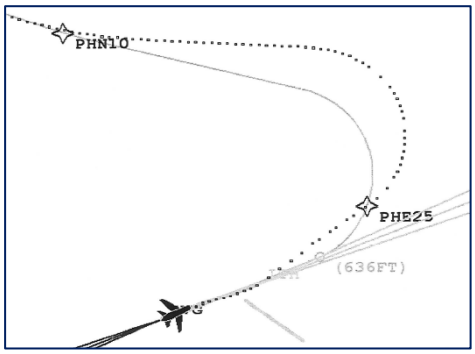


Figure 8: E1-B738-S3

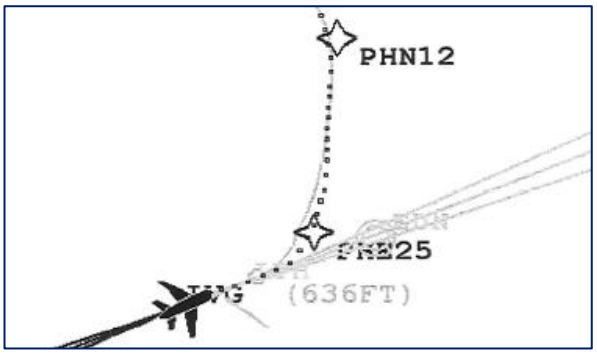
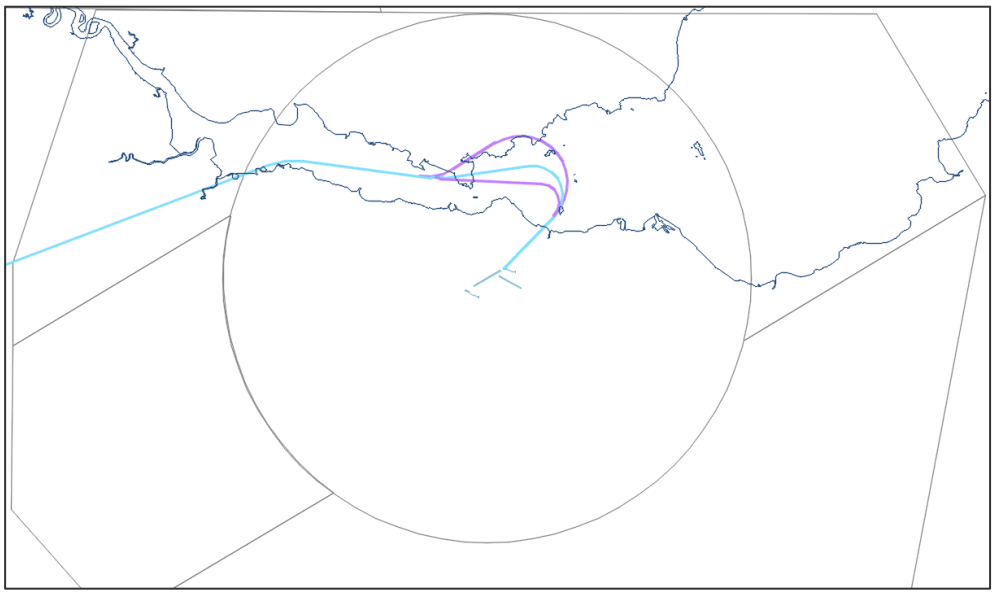


Figure 9: F1-B738-S2

These results show that, while the route is flyable for the B738 and DH8D, waypoint PHE25 is too close to the DER for some aircraft types to achieve, particularly in heavy weight conditions. This option is therefore not being taken forward for inclusion in the ACP.

6.9. Route E Option 2 (ACP Route E7 – ELDER – EMJEE 1D)



Description:	Replacement for GOSAM 1D SID (Jet Only)		
Purpose:	Split southbound and westbound jets from eastbound jets and eastbound, southbound, and westbound non-jets using a late fly-over waypoint		
Aircraft Types:	A320, A330, B733, B738, B788, E170, E190		
	Scenario 1	**Scenario 2**	**Scenario 3**
Wind Direction:	Still	150°	360°
Wind Speed:	Still	30kts	30kts
Surface Temp:	15°C	25°C	-5°C
Pressure:	1013.2hPa	980hPa	1025hPa
Aircraft Weight:	MTOW	MTOW	Min TOW
Objective:	Base case climb performance	Can level restrictions be met in worst case climb conditions?	Are there any track keeping issues in best case climb conditions?
A320 Run ID:	E2-A320-S1	E2-A320-S2	E2-A320-S3
B738 Run ID:	E2-B738-S1	E2-B738-S2	E2-B738-S3
DH8D Run ID:	N/A	N/A	N/A
B763 Run ID:	E2-B763-S1	E2-B763-S2	E2-B763-S3
Notes:	• SID must be flown to termination point • Assume climb clearance to FL300		

Description:	Replacement for GOSAM 1D SID (Jet Only)	
Purpose:	Split southbound and westbound jets from eastbound jets and eastbound, southbound, and westbound non-jets using a late fly-over waypoint	
Aircraft Types:	A320, A330, B733, B738, B788, E170, E190	
	Scenario 4	**Scenario 5**
Wind Direction:	150°	Still
Wind Speed:	30kts	Still
Surface Temp:	25°C	15°C
Pressure:	980hPa	1013.2hPa
Aircraft Weight:	MTOW	Average
Objective:	Can level restrictions be met in worst case climb conditions?	Average conditions
A320 Run ID:	E2-A320-S4	E2-A320-S5
Notes:	• Assume climb clearance to FL300	

Runs Completed

	Scenario 1	**Scenario 2**	**Scenario 3**
A320 Run ID:	E2-A320-S1	E2-A320-S2	E2-A320-S3
B738 Run ID:	E2-B738-S1	E2-B738-S2	E2-B738-S3
DH8D Run ID:	N/A	N/A	N/A
B763 Run ID:	E2-B763-S1	E2-B763-S2	E2-B763-S3

	Scenario 4	**Scenario 5**
A320 Run ID:	E2-A320-S4	E2-A320-S5

Results

	Acceptable	**Not Acceptable**	**Deferred**
A320:	Acceptable		
B738:	Acceptable		
DH8D:			
B763:		Not Acceptable	

Observations

A320:	Sessions 1-8: Aircraft unable to navigate to PHE26 (0.2NM out) Session 9: Flight Director was deflecting left/right frequently within first 3-400ft alt. Pilot preferred to engage autopilot after course correction initiated.
B738:	
DH8D:	
B763:	Late establishment onto CF leg prior to PHE26 (0.1NM out)

Findings (Sessions 1-8)

The A320 and B763 had trouble establishing on the CF leg to PHE26. The data files show that the A320 was approximately 0.15NM to the right of the waypoint on run E2-A320-S1

The data files show that the B763 was approximately 0.4NM to the right of the waypoint on run E2-B763-S1. While we don't have a data file for run E2-B763-S2, the validation form indicates that the aircraft was only 0.1NM off track on that run. The screenshots from the B763 do not show any waypoints so it is impossible to judge the track deviation from them.

Unfortunately we didn't have time to fly Scenario 3 in either the A320 or the B763 so all the data that we have relates to Maximum Take-Off Weight aircraft. As expected, the maximum weight aircraft did not achieve 500ft AAL prior to the DER with the A320 reaching 500ft 0.2NM beyond the DER and the B763 reaching 500ft 0.55NM beyond the DER on run E2-B763-S1.

The B738 had no problem with this procedure and completed all three scenarios. The screenshots from these runs show the aircraft passing directly over PHE26 and then commencing a turn to PHN11. The screenshot from run F2-B738-S2 also shows the aircraft overflying PHE26.

The DH8D did not fly Route E Option 2 but flew the same initial track for Route F Option 2. The data files show that the aircraft was within 0.1NM of PHE26 on both run F2-DH8D-S1 and F2-DH8D-S3.

Figure 10 shows the tracks recorded for the A320, DH8D, and B763 for Route E Option 2 and Route F Option 2. The A320 tracks are in green, the B763 tracks are in red, and the DH8D tracks are in dark blue. The expected average track is in light blue and the expected swathe is in purple. Waypoints and notes are in orange. Figures 11-14 show the screenshots from the B738 runs.

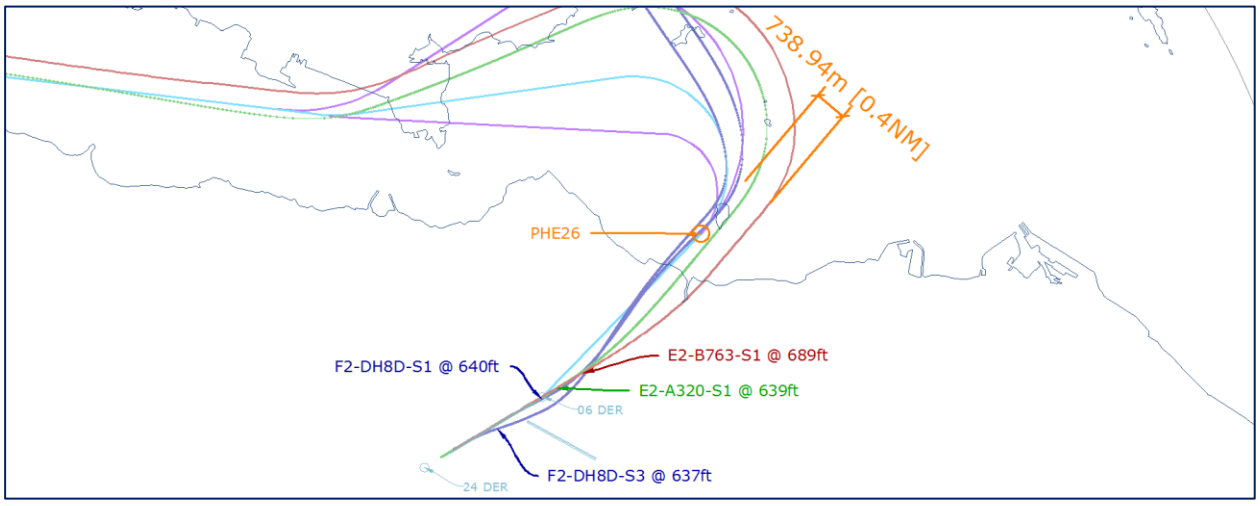


Figure 10: Routes E and F Option 2 Tracks

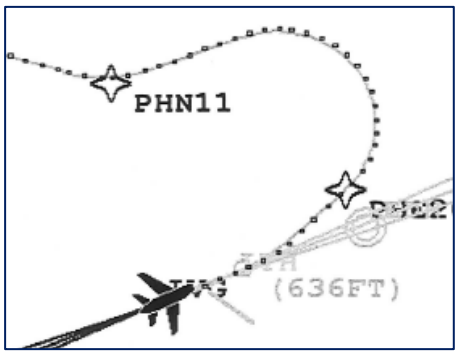


Figure 11: E2-B738-S1

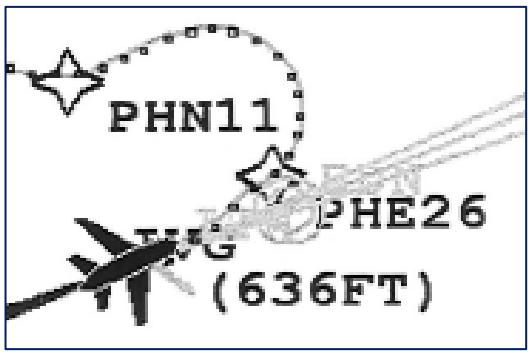


Figure 12: E2-B738-S2

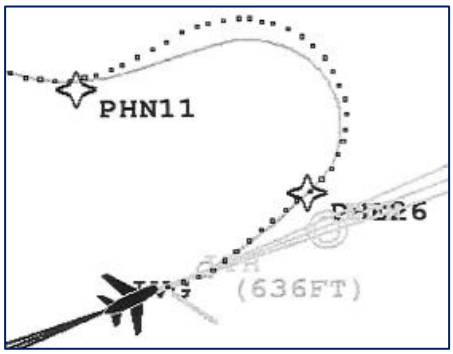


Figure 13: E2-B738-S3

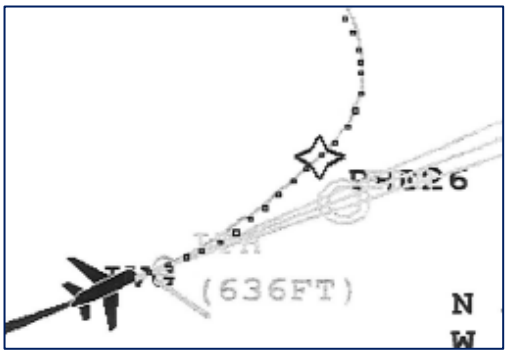


Figure 14: F2-B738-S2

While this route was recorded as “Not Acceptable” by the B763, both run E2-B763-S2 and the similar F2-B763-S2 are noted as being on track (or within 0.1NM of the waypoint) at PHE26. Examining run E2-B763-S1 it seems that the aircraft remained approximately 0.3NM to the right of track throughout the procedure. It does not fly the DF leg to PHN11 correctly and doesn’t attempt to intercept the TF leg from PHN11 to PHW17. This run therefore seems to have anomalies beyond PHE26 and raises questions as to whether the procedure was flown properly.

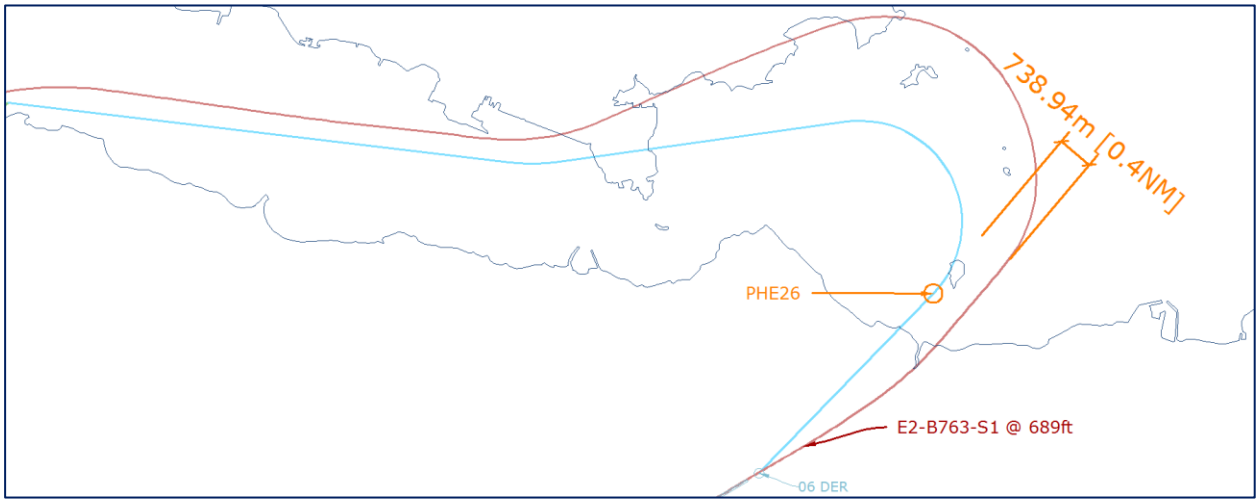


Figure 15: E2-B763-S1

This route was also recorded as “Not Acceptable” by the A320. However we only have one run on which to base this assessment, and evidence from other runs suggests that the aircraft would be able to overfly PHE26, even in the heaviest and most adverse conditions. Of the fourteen easterly departure tracks recorded for the A320, nine of them pass within 0.1NM of PHE26. Of the

remaining five, one is an outlier which seems not to have been flown properly, and the other four are within 0.15NM of PHE26.

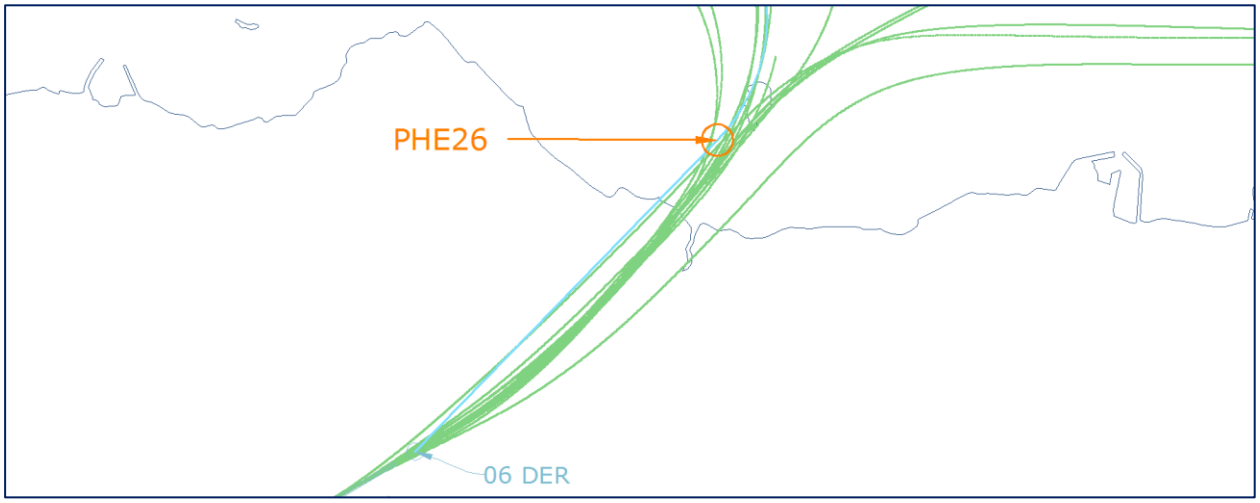


Figure 16: A320 Easterly Departure Tracks

Reviewing the data files, it also seems that the A320 isn't making a significant effort to intercept the CF leg. While the aircraft reaches 500ft AAL shortly after DER, it does not bank by more than 15° until it is above 1500ft and seems to roll out on a track parallel to the CF leg rather than continuing the turn to intercept it.

The A320 pilot pointed out that as the coding table had the speed restrictions listed as a number without a "+" or "-"the coding houses had interpreted this as an "at" speed restriction. This meant that the aircraft was attempting to accelerate to reach the target speed as quickly as possible. This was not the intention as the draft charts show the speed restrictions as "MAX" speed limits. This may be a contributing factor to the A320 having trouble with these procedures.

This route will be taken forward for inclusion in the ACP as the preferred option for jets departing to the West. The coding table will be revised to show the speed restrictions as maximum speeds. The issues with the B763 are believed to be an anomaly and the evidence from Route F Option 2 supports the flyability of this procedure. The issues with the A320 will be investigated through a further simulator validation session.

Findings (Session 9)

The supplemental simulator validation session tested a revised coding for this route which coded the speed restrictions as "-220". The speed profile of the aircraft was broadly similar to the initial simulator validation sessions. However the aircraft was less than 0.1NM away from PHW26 on both runs.

Figure 17 shows the tracks recorded for the Initial A320, Supplemental A320, DH8D, and B763 for Route E Option 2 and Route F Option 2. The Initial A320 tracks are in green, the Supplemental A320 tracks are in brown, the B763 tracks are in red, and the DH8D tracks are in dark blue. The expected average track is in light blue and the expected swathe is in purple. Waypoints and notes are in orange.

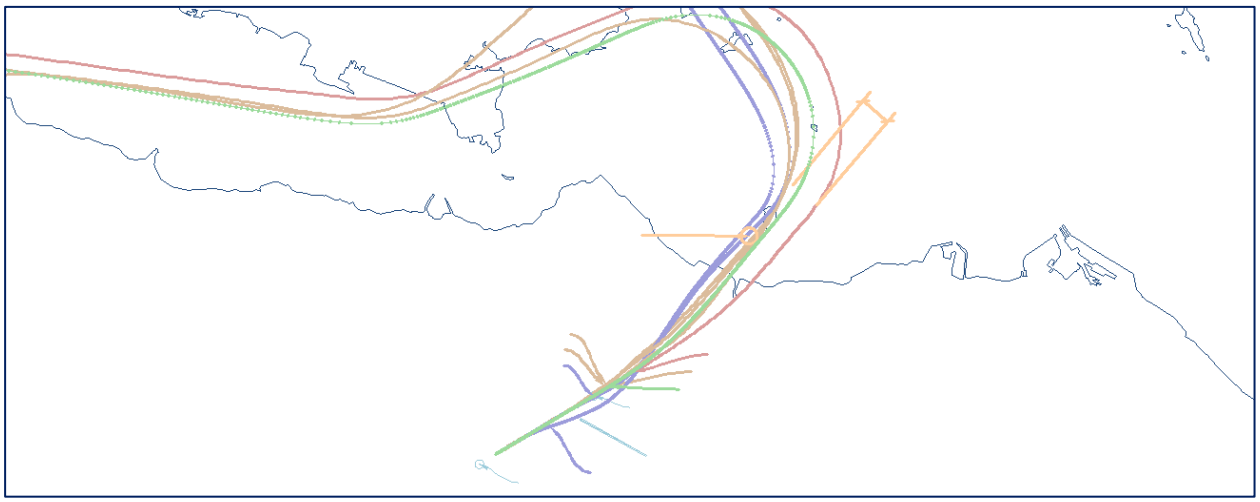
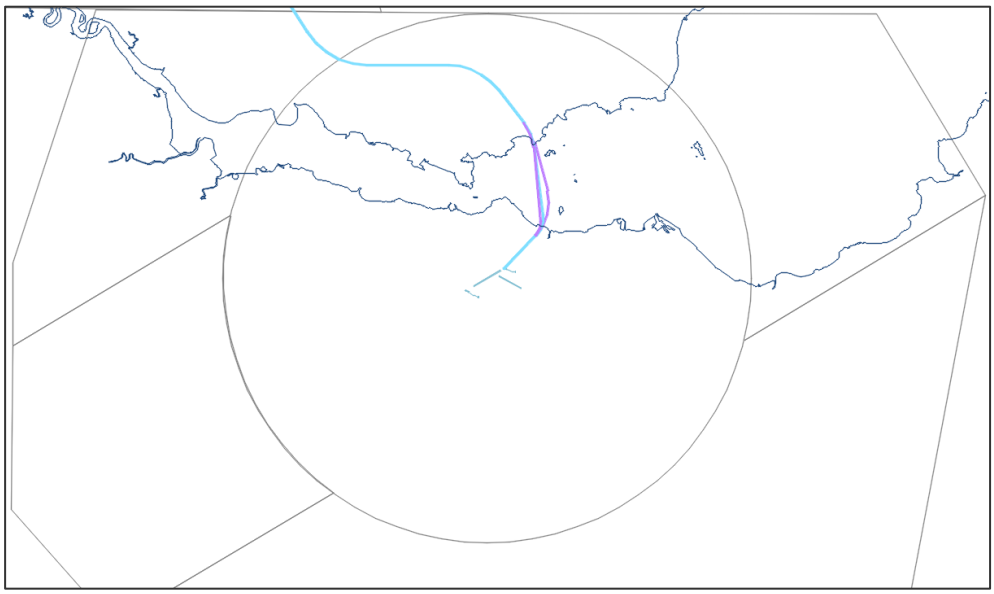


Figure 17: Routes E and F Option 2 Tracks

While this route was found to be flyable, the CAA raised concerns about the possibility of aircraft initiating their first turn before the DER and requested that the initial legs be redesigned to prevent this possibility. Six possible coding options were considered and assessed in sessions 10 and 11. (See sections 6.19 to 6.24.) Of those, “EMJEE 1U” was considered to be the preferred option and was found to be flyable.

This route will be taken forward for inclusion in the ACP as modified by EMJEE 1U.

6.10. Route F Option 1 (Consultation Route F2)



Description:	Replacement for GRICE 4D SID		
Purpose:	Split northbound aircraft from eastbound jets and all other non-jets using an early fly-over waypoint		
Aircraft Types:	A320, A330, B733, B738, B752, B763, B788, D328, SB20, SF34		
	Scenario 1	**Scenario 2**	**Scenario 3**
Wind Direction:	Still	150°	360°
Wind Speed:	Still	30kts	30kts
Surface Temp:	15°C	25°C	-5°C
Pressure:	1013.2hPa	980hPa	1025hPa
Aircraft Weight:	MTOW	MTOW	Min TOW
Objective:	Base case climb performance	Can level restrictions be met in worst case climb conditions?	Are there any track keeping issues in best case climb conditions?
A320 Run ID:	N/A *	F1-A320-S2	N/A *
B738 Run ID:	N/A *	F1-B738-S2	N/A *
DH8D Run ID:	F1-DH8D-S1	F1-DH8D-S2	F1-DH8D-S3
B763 Run ID:	N/A *	F1-B763-S2	N/A *
Notes:	• Run can terminate once established on final leg • Assume climb clearance to FL240		

** Jets will test the full fly-over turn for Route E Option 1. For Route F Option 1 the only test required is that they can meet the Route F Option 1 level restrictions in the worst case climb conditions.*

Runs Completed

	Scenario 1	Scenario 2	Scenario 3
A320 Run ID:	N/A	F1-A320-S2	N/A
B738 Run ID:	N/A	F1-B738-S2	N/A
DH8D Run ID:	F1-DH8D-S1	F1-DH8D-S2	F1-DH8D-S3
B763 Run ID:	N/A	F1-B763-S2	N/A

Results

	Acceptable	Not Acceptable	Deferred
A320:		Not Acceptable	
B738:	Acceptable		
DH8D:	Acceptable		
B763:		Not Acceptable	

Observations

A320:	Aircraft unable to navigate to second waypoint successfully. PHE 25 and PHN12 not sequenced.
B738:	
DH8D:	
B763:	Late establishment onto CF leg prior to PHE25 (0.1NM out)

Findings (Sessions 1-8)

The A320 and B763 had trouble establishing on the CF leg to PHE25. The data files show that the A320 was approximately 0.2NM to the right of the waypoint on run F1-A320-S2. Route E Option 1 shares the same initial coding as far as PHE25 and the A320 was between 0.15NM and 0.2NM to the right of the waypoint on runs E1-A320-S1 and E1-A320-S2.

While we don't have a data file for run F1-B763-S2, the validation form indicates that the aircraft was off track at the waypoint although the distance isn't recorded. The screenshots from the B763 do not show any waypoints so it is impossible to judge the track deviation from them.

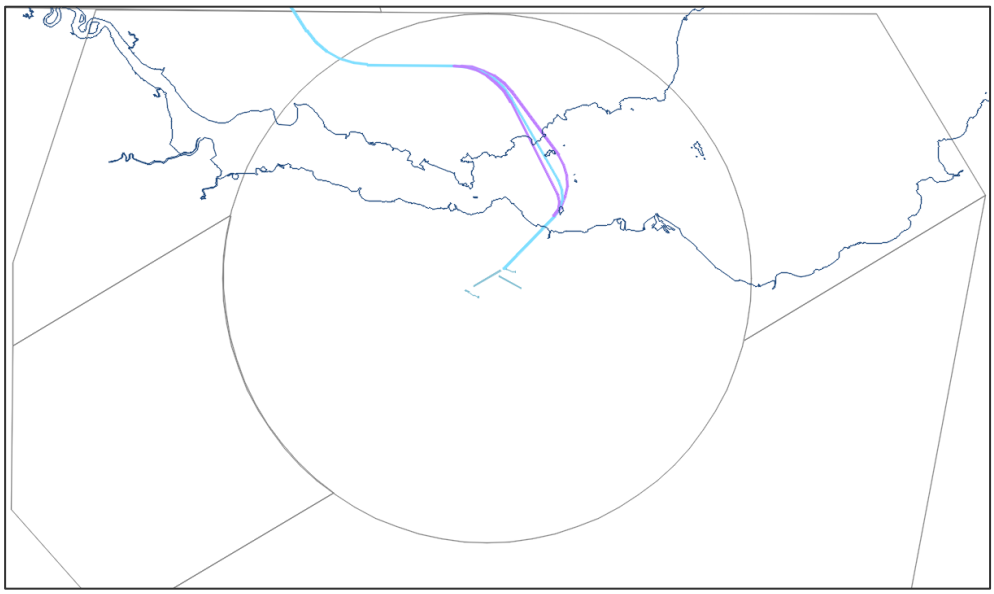
The B738 had no problem with this procedure and the screenshot from this run shows the aircraft passing directly over PHE25 and then commencing a turn to PHN12. The screenshots from the Route E Option 1 runs also show the aircraft overflying PHE25.

The data files show that the DH8D was within 0.1NM of PHE25 on both runs.

Figures 5-9 in section 6.7 show the tracks and screenshots for Route E Option 1 and Route F Option 1.

These results show that, while the route is flyable for the B738 and DH8D, waypoint PHE25 is too close to the DER for some aircraft types to achieve, particularly in heavy weight conditions. This option is therefore not being taken forward for inclusion in the ACP.

6.11. Route F Option 2 (ACP Route F2a – FLORA – GRICE 5D)



Description:	Replacement for GRICE 4D SID		
Purpose:	Split northbound aircraft from eastbound jets and all other non-jets using a late fly-over waypoint		
Aircraft Types:	A320, A330, B733, B738, B752, B763, B788, D328, SB20, SF34		
	Scenario 1	**Scenario 2**	**Scenario 3**
Wind Direction:	Still	150°	360°
Wind Speed:	Still	30kts	30kts
Surface Temp:	15°C	25°C	-5°C
Pressure:	1013.2hPa	980hPa	1025hPa
Aircraft Weight:	MTOW	MTOW	Min TOW
Objective:	Base case climb performance	Can level restrictions be met in worst case climb conditions?	Are there any track keeping issues in best case climb conditions?
A320 Run ID:	N/A *	F2-A320-S2	N/A *
B738 Run ID:	N/A *	F2-B738-S2	N/A *
DH8D Run ID:	F2-DH8D-S1	F2-DH8D-S2	F2-DH8D-S3
B763 Run ID:	N/A *	F2-B763-S2	N/A *
Notes:	• Run can terminate once established on final leg • Assume climb clearance to FL240		

** Jets will test the full fly-over turn for Route E Option 1. For Route F Option 1 the only test required is that they can meet the Route F Option 1 level restrictions in the worst case climb conditions.*

Description:	Replacement for GRICE 4D SID		
Purpose:	Split northbound aircraft from eastbound jets and all other non-jets using an early fly-over waypoint		
Aircraft Types:	A320, A330, B733, B738, B752, B763, B788, D328, SB20, SF34		
	Scenario 4		
Wind Direction:	150°		
Wind Speed:	30kts		
Surface Temp:	25°C		
Pressure:	980hPa		
Aircraft Weight:	MTOW		
Objective:	Can level restrictions be met in worst case climb conditions?		
A320 Run ID:	F2-A320-S4	F1-A320-S2	N/A *
Notes:	• Assume climb clearance to FL240		

Runs Completed

	Scenario 1	Scenario 2	Scenario 3
A320 Run ID:	N/A	F2-A320-S2	N/A
B738 Run ID:	N/A	F2-B738-S2	N/A
DH8D Run ID:	F2-DH8D-S1	F2-DH8D-S2	F2-DH8D-S3
B763 Run ID:	N/A	F2-B763-S2	N/A

	Scenario 4
A320 Run ID:	F2-A320-S4

Results

	Acceptable	Not Acceptable	Deferred
A320:	Acceptable		
B738:	Acceptable		
DH8D:	Acceptable		
B763:	Acceptable		

Observations

A320:	Flight Director was deflecting left/right frequently within first 3-400ft alt. Pilot preferred to engage autopilot after course correction initiated.
B738:	
DH8D:	
B763:	

Findings (Sessions 1-8)

This route was not flown by the A320 but was found to be acceptable by the other three aircraft types.

While we don't have a data file for run F2-B763-S2, the validation form indicates that the aircraft was on track at the waypoint. The screenshots from the B763 do not show any waypoints so it is impossible to judge the track deviation from them.

The B738 had no problem with this procedure and the screenshot from this run shows the aircraft passing directly over PHE26 and then commencing a turn to PHN15. The screenshots from the Route E Option 2 runs also show the aircraft overflying PHE26.

The data files show that the DH8D was within 0.1NM of PHE25 on both runs.

Figures 10-14 in section 6.9 show the tracks and screenshots for Route E Option 2 and Route F Option 2.

This route will be taken forward for inclusion in the ACP as the preferred option for aircraft departing to the North. In accordance with the findings from Route E Option 2, the coding table will be revised to show the speed restrictions as maximum speeds. The flyability of this procedure in an A320 will be investigated through a further simulator validation session.

Findings (Session 9)

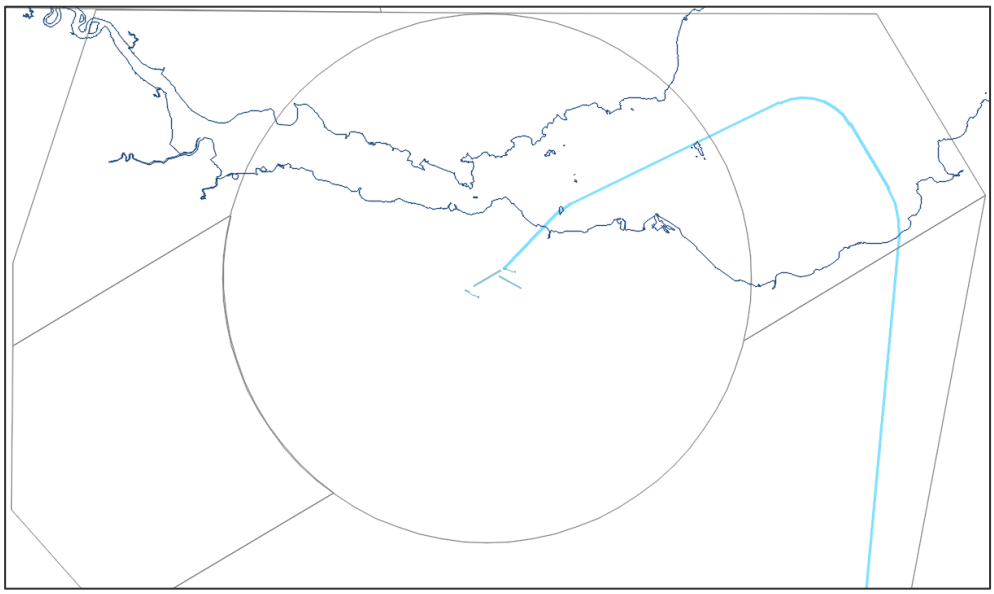
The supplemental simulator validation session tested a revised coding for this route which coded the speed restrictions as "-220". Only one run was conducted by the aircraft but it was less than 0.1NM away from PHW26.

Figure 17 in section 6.9 shows the tracks recorded for Route E Option 2 and Route F Option 2.

While this route was found to be flyable, the CAA raised concerns about the possibility of aircraft initiating their first turn before the DER and requested that the initial legs be redesigned to prevent this possibility. Six possible coding options were considered and assessed in sessions 10 and 11. (See sections 6.19 to 6.24.) Of those, "EMJEE 1U" was considered to be the preferred option and was found to be flyable.

This route will be taken forward for inclusion in the ACP as modified by EMJEE 1U.

6.12. Route G (ACP Route G5 – DOWEL – VOSNE 1D)



Description:	New SID climbing over the Firth of Forth (Jet Only)		
Purpose:	Remove eastbound jets from TALLA SID and split from all other aircraft		
Aircraft Types:	A320, A330, B733, B738, B788, E190		
	Scenario 1	**Scenario 2**	**Scenario 3**
Wind Direction:	Still	330°	060°
Wind Speed:	Still	30kts	30kts
Surface Temp:	15°C	25°C	-5°C
Pressure:	1013.2hPa	980hPa	1025hPa
Aircraft Weight:	MTOW	MTOW	Min TOW
Objective:	Base case climb performance	Can level restrictions be met in worst case climb conditions?	Are there any track keeping issues in best case climb conditions?
A320 Run ID:	G-A320-S1	G-A320-S2	G-A320-S3
B738 Run ID:	G-B738-S1	G-B738-S2	G-B738-S3
DH8D Run ID:	N/A	N/A	N/A
B763 Run ID:	G-B763-S1	G-B763-S2	G-B763-S3
Notes:	• SID must be flown to termination point • Assume climb clearance to FL300		

Description:	New SID climbing over the Firth of Forth (Jet Only)	
Purpose:	Remove eastbound jets from TALLA SID and split from all other aircraft	
Aircraft Types:	A320, A330, B733, B738, B788, E190	
	Scenario 4	**Scenario 5**
Wind Direction:	330°	Still
Wind Speed:	30kts	Still
Surface Temp:	25°C	15°C
Pressure:	980kPa	1013.2hPa
Aircraft Weight:	MTOW	Average
Objective:	Can level restrictions be met in worst case climb conditions?	Average conditions
A320 Run ID:	G-A320-S4	G-A320-S5
Notes:	• Assume climb clearance to FL300	

Runs Completed

	Scenario 1	**Scenario 2**	**Scenario 3**
A320 Run ID:	G-A320-S1	G-A320-S2	G-A320-S3
B738 Run ID:	G-B738-S1	G-B738-S2	G-B738-S3
DH8D Run ID:	N/A	N/A	N/A
B763 Run ID:	G-B763-S1	G-B763-S2	G-B763-S3

	Scenario 4	**Scenario 5**
A320 Run ID:	G-A320-S4	G-A320-S5

Results

	Acceptable	**Not Acceptable**	**Deferred**
A320:	Acceptable		
B738:	Acceptable		
DH8D:			
B763:	Acceptable		

Observations

A320:	Sessions 1-8: Aircraft unable to navigate to second waypoint. (0.1NM out at PHE27) Session 9: Flight Director was deflecting left/right frequently within first 3-400ft alt. Pilot preferred to engage autopilot after course correction initiated.
B738:	
DH8D:	
B763:	Light weight – would request for an earlier turn for commercial reasons Heavy weight – turn at PHE24 large enough that it requires 220kts but that required flaps extended for significant ally longer than desired. Also possibly then missing altitude restriction at PHE110 (weight dependent).

Findings (Sessions 1-8)

The A320 reported that it had trouble establishing on the CF leg to PHE27. The data files show that the A320 was between 0.075NM and 0.1NM to the right of the waypoint on runs G-A320-S1 and G-A320-S2. However, as PHE27 is a fly-by waypoint we would expect aircraft to be slightly to the right of the waypoint anyway. Both tracks are well within 0.1NM of our expected average track.

The B738 had no problem with this procedure and completed all three scenarios. The screenshots from these runs show the aircraft passing just to the right of PHE27 and rolling out on track to PHE24.

The data files show that the B763 was between approximately 0.065NM and 0.12NM to the right of the waypoint on runs G-B763-S1 and G-B763-S2-v2. While we don't have a data file for run G-B763-S3, the validation form indicates that the aircraft was established safely on the CF leg prior to PHE27. The screenshots from the B763 do not show any waypoints so it is impossible to judge the track deviation from them.

Unfortunately we didn't have time to fly Scenario 3 in the A320 and don't have data files run G-B763-S3 so all the data that we have relates to Maximum Take-Off Weight aircraft. As expected, the maximum weight aircraft did not achieve 500ft AAL prior to the DER with the A320 reaching 500ft between 0.15NM and 0.25NM beyond the DER and the B763 reaching 500ft 0.55NM beyond the DER.

Figure 18 shows the tracks recorded for the A320 and B763 for Route G. The A320 tracks are in green and the B763 tracks are in red. The desired average track is in light blue and waypoints and notes are in orange. Figures 18-20 show the screenshots from the B738 runs.

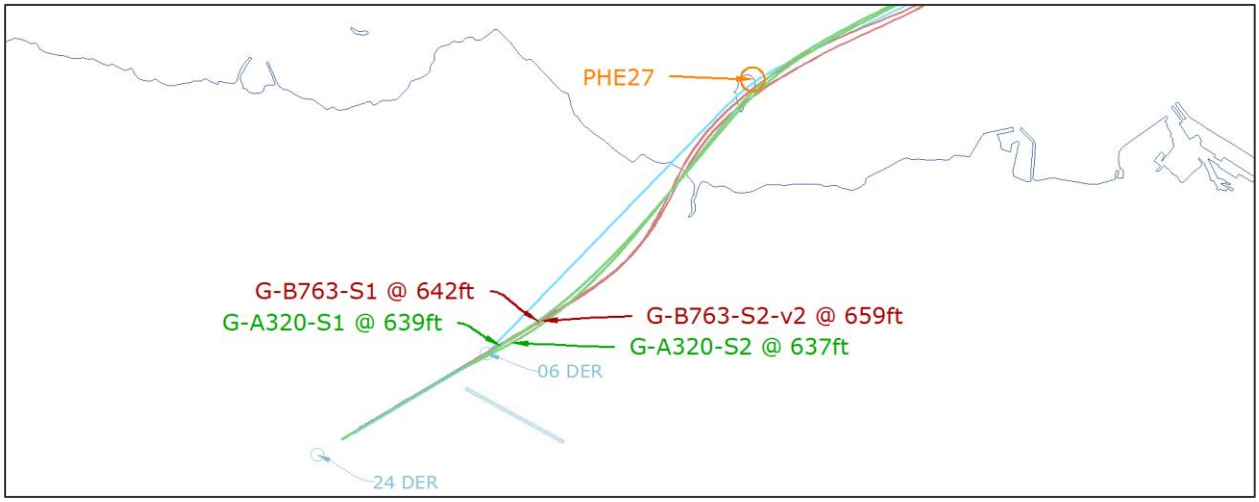


Figure 18: Route G Tracks

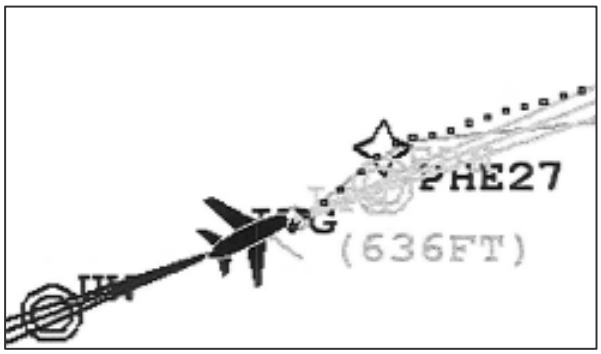


Figure 19: G-B738-S1

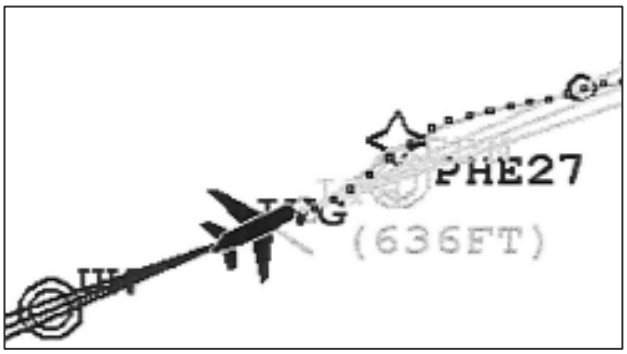


Figure 20: G-B738-S2

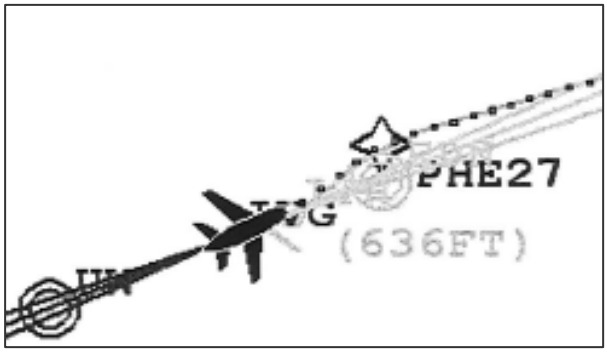


Figure 21: G-B738-S3

This route was recorded as “Not Acceptable” by the A320. However this seems to be based purely on the aircraft being 0.1NM off track at PHE27. Reviewing the data files the track looks acceptable and is certainly no worse than the B763 which was recorded as “Acceptable”.

Reviewing the data files, it also seems that the A320 isn’t making a significant effort to intercept the CF leg. While the aircraft reaches 500ft AAL shortly after DER, it does not bank by more than 15° until it is above 1500ft and seems to roll out on a track parallel to the CF leg rather than continuing the turn to intercept it. This may be a result of the speed restrictions being coded as “at”, resulting in the aircraft accelerating more than normal.

This route will be taken forward for inclusion in the ACP as the preferred option for jets departing to the East. The coding table will be revised to show the speed restrictions as maximum speeds. The issues with the A320 will be investigated through a further simulator validation session.

Findings (Session 9)

The supplemental simulator validation session tested a revised coding for this route which coded the speed restrictions as "-220". The speed profile of the aircraft was broadly similar to the initial simulator validation sessions. The lateral track keeping was slightly better with all runs passing within 0.1NM of PHE27.

Figure 22shows the tracks recorded for the Initial A320, Supplemental A320, and B763 for Route G. The Initial A320 tracks are in green, the Supplemental A320 tracks are in brown, and the B763 tracks are in red. The desired average track is in light blue and waypoints and notes are in orange.

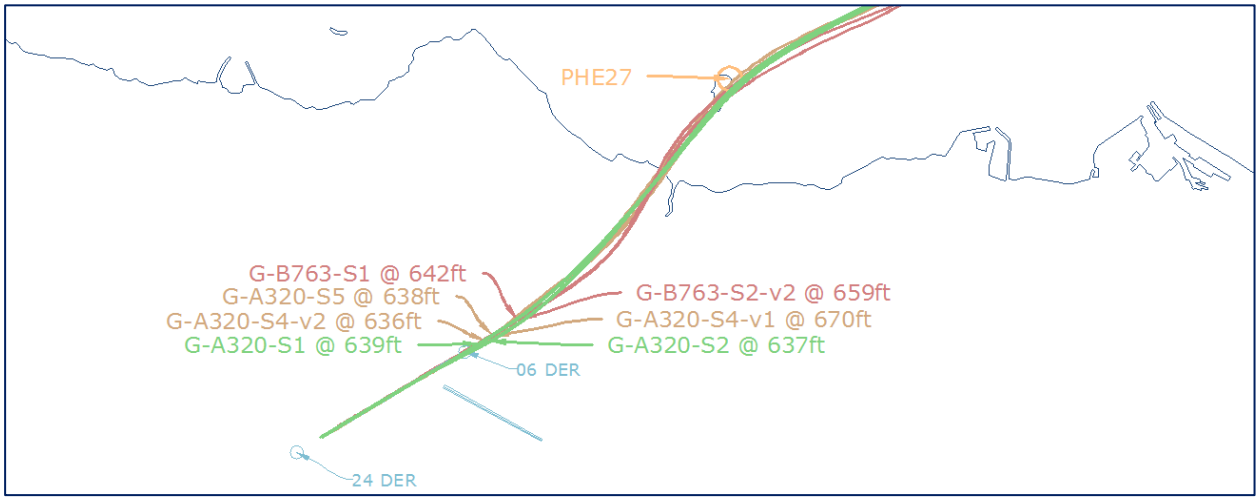
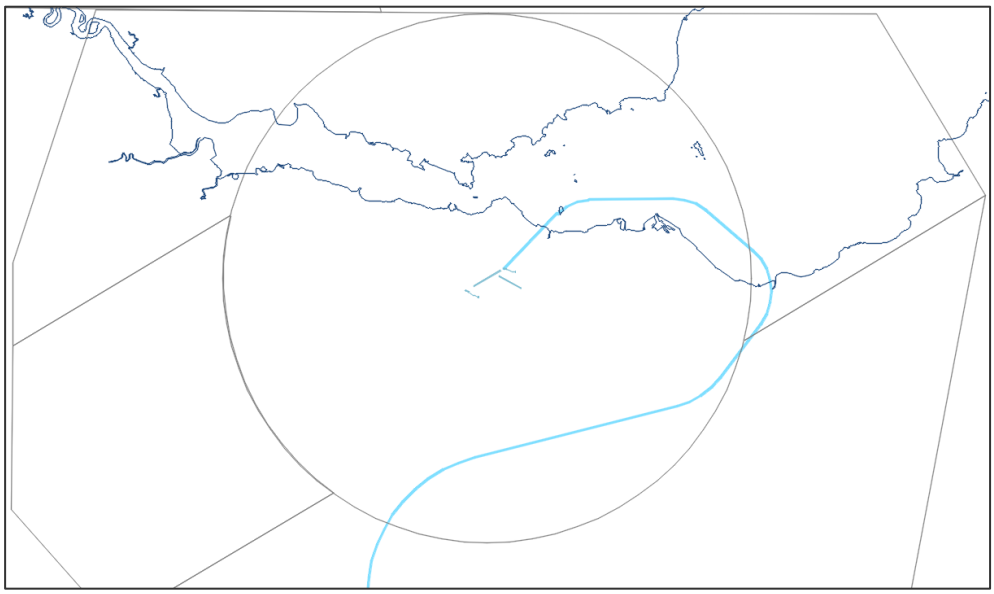


Figure 22: Route G Tracks

While this route was found to be flyable, the CAA raised concerns about the possibility of aircraft initiating their first turn before the DER and requested that the initial legs be redesigned to prevent this possibility. Six possible coding options were considered and assessed in sessions 10 and 11. (See sections 6.25 to 6.30.) Of those, "KRAGY 1U" was considered to be the preferred option and was found to be flyable.

This route will be taken forward for inclusion in the ACP as modified by KRAGY 1U.

6.13. Route H1 (ACP Route H2 – HEATH – KRAGY 1D)



Description:	Replacement for TALLA 6D SID (Non-Jet Only)		
Purpose:	Split eastbound, southbound, and westbound non-jets from all other aircraft		
Aircraft Types:	AT76, D328, DH8D		
	Scenario 1	**Scenario 2**	**Scenario 3**
Wind Direction:	Still	330°	090°
Wind Speed:	Still	30kts	30kts
Surface Temp:	15°C	25°C	-5°C
Pressure:	1013.2hPa	980hPa	1025hPa
Aircraft Weight:	MTOW	MTOW	Min TOW
Objective:	Base case climb performance	Can level restrictions be met in worst case climb conditions?	Are there any track keeping issues in best case climb conditions?
A320 Run ID:	N/A	N/A	N/A
B738 Run ID:	N/A	N/A	N/A
DH8D Run ID:	H1-DH8D-S1	H1-DH8D-S2	H1-DH8D-S3
B763 Run ID:	N/A	N/A	N/A
Notes:	• Run can terminate once established on final leg • Assume climb clearance to FL240		

Description:	Replacement for TALLA 6D SID (Non-Jet Only)	
Purpose:	Split eastbound, southbound, and westbound non-jets from all other aircraft	
Aircraft Types:	AT76, D328, DH8D	
	Scenario 4	**Scenario 5**
Wind Direction:	330°	Still
Wind Speed:	30kts	Still
Surface Temp:	25°C	15°C
Pressure:	980kPa	1013.2hPa
Aircraft Weight:	MTOW	Average
Objective:	Can level restriction be met in worst case climb conditions?	Average conditions
A320 Run ID:	H1-A320-S4	H1-A320-S5
Notes:	• Assume climb clearance to FL240	

Runs Completed

	Scenario 1	**Scenario 2**	**Scenario 3**
A320 Run ID:	N/A	N/A	N/A
B738 Run ID:	N/A	N/A	N/A
DH8D Run ID:	H1-DH8D-S1	H1-DH8D-S2	H1-DH8D-S3
B763 Run ID:	N/A	N/A	N/A

	Scenario 4	**Scenario 5**
A320 Run ID:	H1-A320-S4	H1-A320-S5

Results

	Acceptable	**Not Acceptable**	**Deferred**
A320:	Acceptable		
B738:			
DH8D:	Acceptable		
B763:			

Observations

A320:	Flight Director was deflecting left/right frequently within first 3-400ft alt. Pilot preferred to engage autopilot after course correction initiated.
B738:	
DH8D:	
B763:	

Findings (Sessions 1-8)

No changes are required. This route will be taken forward for inclusion in the ACP. It will now be flown by both non-jets and jets. For simulator validation evidence for jets please see section 6.14.

Findings (Session 9)

The supplemental simulator validation session tested a revised coding for this route which coded the speed restrictions as “-220”. The speed profile of the aircraft was broadly similar to the initial simulator validation sessions. The lateral track keeping was slightly better with all runs passing within 0.1NM of PHE12.

Figure 23 shows the tracks recorded for the Initial A320, Supplemental A320, DH8D, and B763 for Route H1 and Route H2. The Initial A320 tracks are in green, the Supplemental A320 tracks are in brown, the B763 tracks are in red, and the DH8D tracks are in dark blue. The desired average track is in light blue and waypoints and notes are in orange.

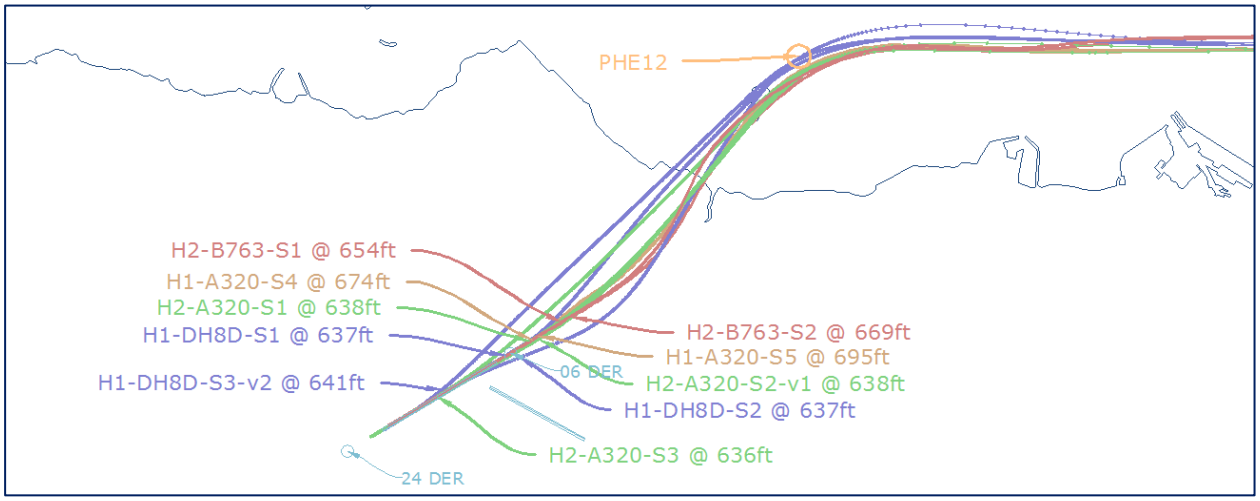
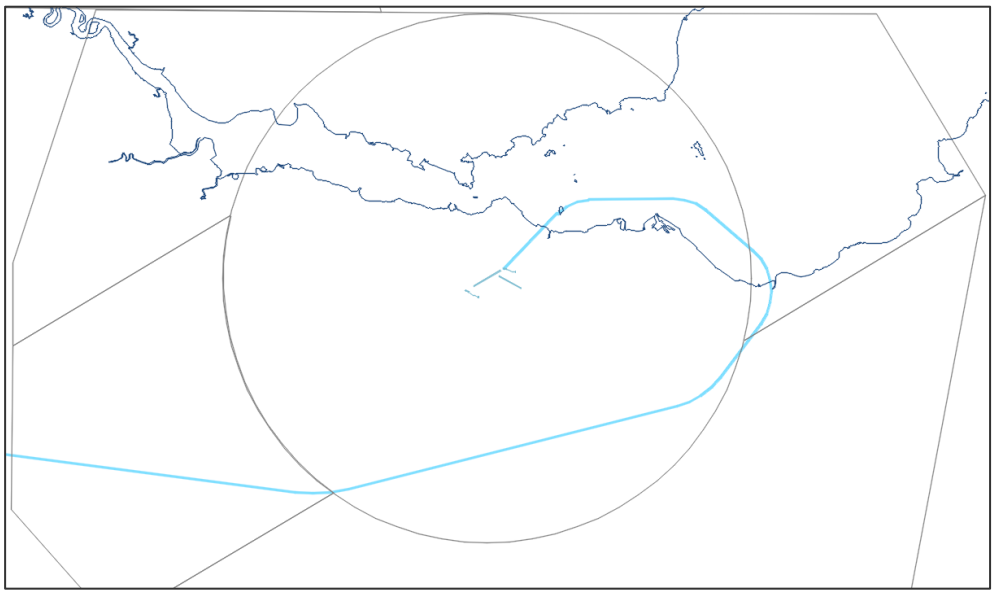


Figure 23: Routes H1 and H2 Tracks

While this route was found to be flyable, the CAA raised concerns about the possibility of aircraft initiating their first turn before the DER and requested that the initial legs be redesigned to prevent this possibility. Six possible coding options were considered and assessed in sessions 10 and 11. (See sections 6.25 to 6.30.) Of those, “KRAGY 1U” was considered to be the preferred option and was found to be flyable.

This route will be taken forward for inclusion in the ACP as modified by KRAGY 1U.

6.14. Route H2 (Consultation Route Hw)



Description:	New SID following H2 route (Jet Only)		
Purpose:	Potential to split southeastbound jets from all other jets and northbound non-jets if a parallel airway is introduced		
Aircraft Types:	A320, A330, B733, B738, B788		
	Scenario 1	**Scenario 2**	**Scenario 3**
Wind Direction:	Still	330°	090°
Wind Speed:	Still	30kts	30kts
Surface Temp:	15°C	25°C	-5°C
Pressure:	1013.2hPa	980hPa	1025hPa
Aircraft Weight:	MTOW	MTOW	Min TOW
Objective:	Base case climb performance	Can level restrictions be met in worst case climb conditions?	Are there any track keeping issues in best case climb conditions?
A320 Run ID:	H2-A320-S1	H2-A320-S2	H2-A320-S3
B738 Run ID:	H2-B738-S1	H2-B738-S2	H2-B738-S3
DH8D Run ID:	N/A	N/A	N/A
B763 Run ID:	H2-B763-S1	H2-B763-S2	H2-B763-S3
Notes:	• Run can terminate once established on final leg • Assume climb clearance to FL300		

Runs Completed

	Scenario 1	**Scenario 2**	**Scenario 3**
A320 Run ID:	H2-A320-S1	H2-A320-S2	H2-A320-S3
B738 Run ID:	H2-B738-S1	H2-B738-S2	H2-B738-S3
DH8D Run ID:	N/A	N/A	N/A
B763 Run ID:	H2-B763-S1	H2-B763-S2	H2-B763-S3

Results

	Acceptable	Not Acceptable	Deferred
A320:		Not Acceptable	
B738:	Acceptable		
DH8D:			
B763:		Not Acceptable	

Observations

A320:	Aircraft unable to navigate to second waypoint successfully unless very light weight. (0.1NM out at PHE 12 for S1 and PHE 12 not sequenced in S2)
B738:	Approximate 0.2NM out on one of the turns
DH8D:	0.2NM out at PHE32 to PHN10
B763:	0.3NM out at PHE29 (S3 only)

Findings (Sessions 1-8)

The A320 reported that it had trouble establishing on the CF leg to PHE12. The data files show that the A320 was between 0.1NM and 0.15NM to the right of the waypoint on all three runs. However, as PHE12 is a fly-by waypoint we would expect aircraft to be slightly to the right of the waypoint anyway. All tracks are within 0.02NM of our expected average track.

The B763 didn't have any problems establishing on the CF leg to PHE12 but reported that it was 0.3NM off track at PHE29 on scenario 3. Unfortunately we don't have a data file for run H2-B763-S3 so we cannot review that run in greater detail. The data files show that the B763 was approximately 0.35NM to the right of PHE29 on run H2-B763-S1 and approximately 1NM to the right of PHE29 on run H2-B763-S2.

The DH8D did not fly Route H2 but flew the same initial track for Route H1. The data files show that the aircraft was within 0.1NM of PHE12 on all three runs.

The B738 had no problem with this procedure and completed all three scenarios. The screenshots from these runs show the aircraft passing just to the right of PHE12 and rolling out on track to PHE28.

Fortunately we were able to fly Scenario 3 in all three aircraft types for this route. We don't have data files for run H2-B763-S3 but we do have data files for all three runs on route H1 which use the same initial track. As expected, the maximum weight aircraft did not achieve 500ft AAL prior to the DER with the A320 reaching 500ft between 0.2NM and 0.3NM beyond the DER and the B763 reaching 500ft between 0.5NM and 0.6NM beyond the DER. However we can see that the maximum weight DH8D reached 500ft abeam the DER and the minimum weight A320 and DH8D reached 500ft approximately half way along the runway.

Figure 24shows the tracks recorded for the A320, DH8D, and B763 for Route H1 and Route H2. The A320 tracks are in green, the B763 tracks are in red, and the DH8D tracks are in dark blue. The desired average track is in light blue and the waypoints and notes are in orange. Figures 25-27 show the screenshots from the B738 runs.

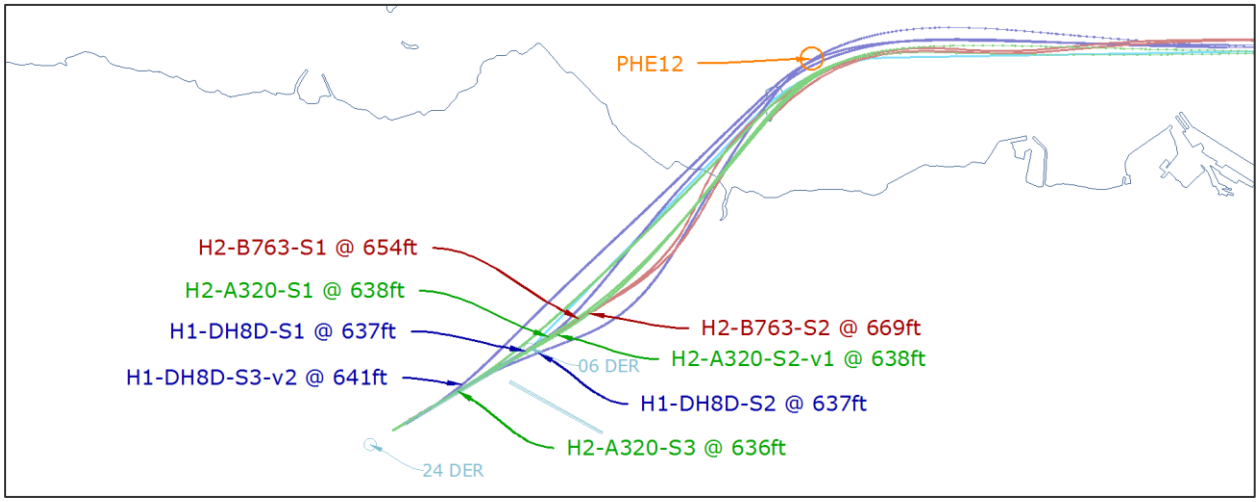


Figure 24: Routes H1 and H2 Tracks

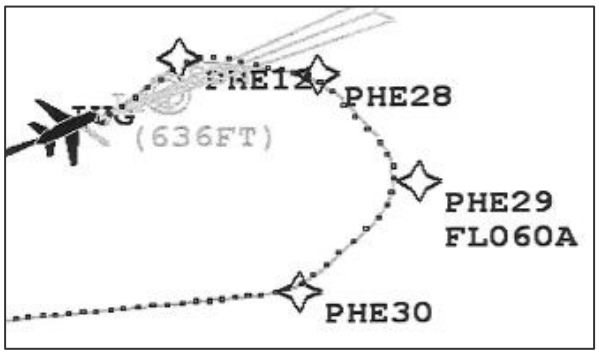


Figure 25: H2-B738-S1

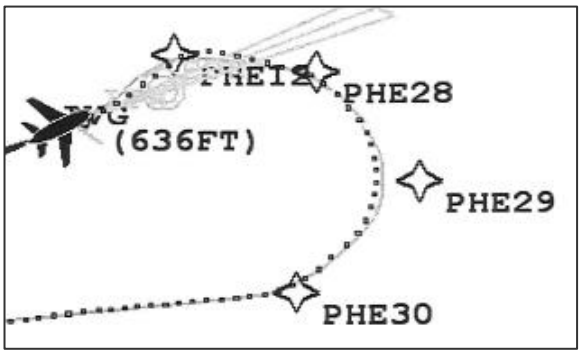


Figure 26: H2-B738-S2

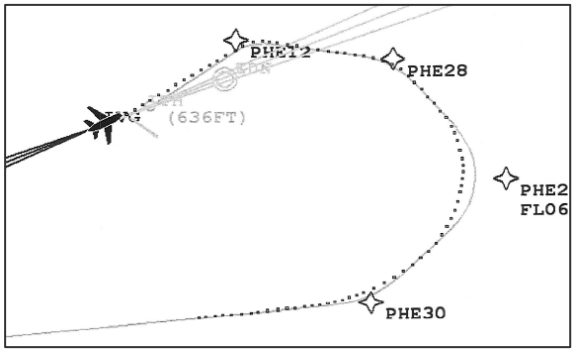


Figure 27: H2-B738-S3

While this route was recorded as “Not Acceptable” by the B763, both run H2-B763-S1 and H2-B763-S2 are noted as being on track (or within 0.1NM of the waypoint) at PHE29. It seems strange that the aircraft was able to fly the route successfully in both maximum weight scenarios but had problems in the minimum weight scenario.

This route was also recorded as “Not Acceptable” by the A320. However this seems to be based on the aircraft being slightly off track at PHE12. Reviewing the data files the tracks look acceptable and are very close to both the expected average track and the B763 tracks which were recorded as “Acceptable”.

Reviewing the data files, it also seems that the A320 isn't making a significant effort to intercept the CF leg. While the aircraft reaches 500ft AAL shortly after DER, it does not bank by more than 15° until it is above 1500ft and seems to roll out on a track parallel to the CF leg rather than continuing the turn to intercept it. This may be a result of the speed restrictions being coded as "at", resulting in the aircraft accelerating more than normal.

This route will not be taken forward for inclusion in the ACP; however Route H1 will be taken forward and will be flown by both non-jets and jets. As the bulk of Route H1 (as far as PHS12) is identical to Route H2 the simulator validation evidence for Route H2 is considered to cover the use of Route H1 by jets. The coding table will be revised to show the speed restrictions as maximum speeds. The issues with the B763 are believed to be an anomaly and are likely to be prevented with the introduction of a "not below FL80" restriction at PHE29. The issues with the A320 will be investigated through a further simulator validation session.

6.15. Route E Option 3

This option was not part of the formal consultation. The intention was to construct a SID with a 17.5° offset to the left to more closely approximate the current conventional tracks and reduce the noise impact on Cramond.

Description:	Replacement for GOSAM 1D SID (Jet Only)		
Purpose:	Split southbound and westbound jets from eastbound jets and eastbound, southbound, and westbound non-jets using an early fly-over waypoint		
Aircraft Types:	A320, A330, B733, B738, B788, E170, E190		
	Scenario 1	**Scenario 2**	**Scenario 3**
Wind Direction:	Still	150°	360°
Wind Speed:	Still	30kts	30kts
Surface Temp:	15°C	25°C	-5°C
Pressure:	1013.2hPa	980hPa	1025hPa
Aircraft Weight:	MTOW	MTOW	Min TOW
Objective:	Base case climb performance	Can level restrictions be met in worst case climb conditions?	Are there any track keeping issues in best case climb conditions?
A320 Run ID:	E3-A320-S1	E3-A320-S2	E3-A320-S3
B738 Run ID:	E3-B738-S1	E3-B738-S2	E3-B738-S3
DH8D Run ID:	E3-DH8D-S1 *	E3-DH8D-S2 *	E3-DH8D-S3 *
B763 Run ID:	E3-B763-S1	E3-B763-S2	E3-B763-S3
Notes:	• Run can terminate once established on final leg • Assume climb clearance to FL300		

** Non-jets will not fly route E but if the simulator validation is successful we would want to implement the same 17.5° track adjustment for route F. If non-jets are able to fly Route E Option 3 then they should be able to fly the less demanding Route F.*

Runs Completed

	Scenario 1	**Scenario 2**	**Scenario 3**
A320 Run ID:	E3-A320-S1	E3-A320-S2	E3-A320-S3
B738 Run ID:	E3-B738-S1	E3-B738-S2	E3-B738-S3
DH8D Run ID:	E3-DH8D-S1	E3-DH8D-S2	E3-DH8D-S3
B763 Run ID:	E3-B763-S1	E3-B763-S2	E3-B763-S3

Results

	Acceptable	**Not Acceptable**	**Deferred**
A320:		Not Acceptable	
B738:	Acceptable		
DH8D:	Acceptable		
B763:		Not Acceptable	

Observations

A320:	Aircraft unable to navigate to second waypoint successfully. (does not sequence PHE32)
B738:	
DH8D:	
B763:	Late establishment onto CF leg prior to PHE32. (0.4 NM out for S1 and 0.2NM out for S2) 1NM out for PHN 10 (S2)

Findings (Sessions 1-8)

The A320 and B763 had trouble establishing on the CF leg to PHE32. The data files show that the A320 was approximately 0.25NM to the right of the waypoint on runs E3-A320-S1 and E3-A320-S2.

The data files show that the B763 was approximately 0.3NM to the right of the waypoint on run E3-B763-S1. While we don't have a data file for run E3-B763-S2, the validation form indicates that the aircraft was approximately 0.2NM off track on that run as well. The screenshots from the B763 do not show any waypoints so it is impossible to judge the track deviation from them.

Unfortunately we didn't have time to fly Scenario 3 in either the A320 or the B763 so all the data that we have relates to Maximum Take-Off Weight aircraft. As expected, the maximum weight aircraft did not achieve 500ft AAL prior to the DER with the A320 reaching 500ft approximately 0.2NM beyond the DER. The B763 reached 500ft 0.55NM beyond the DER on run E3-B763-S1.

The B738 had no problem with this procedure and completed all three scenarios. The screenshots from these runs show the aircraft passing directly over PHE32 and then commencing a turn to PHN10.

The DH8D had no problem with this procedure. The data files show that the aircraft was within 0.15NM of PHE32 on both runs.

Figure 28 shows the tracks recorded for the A320, DH8D, and B763 for Route E Option 3. The A320 tracks are in green, the B763 tracks are in red, and the DH8D tracks are in dark blue. The expected average track is in light blue and the waypoints and notes are in orange. Figures 29-31 show the screenshots from the B738 runs.

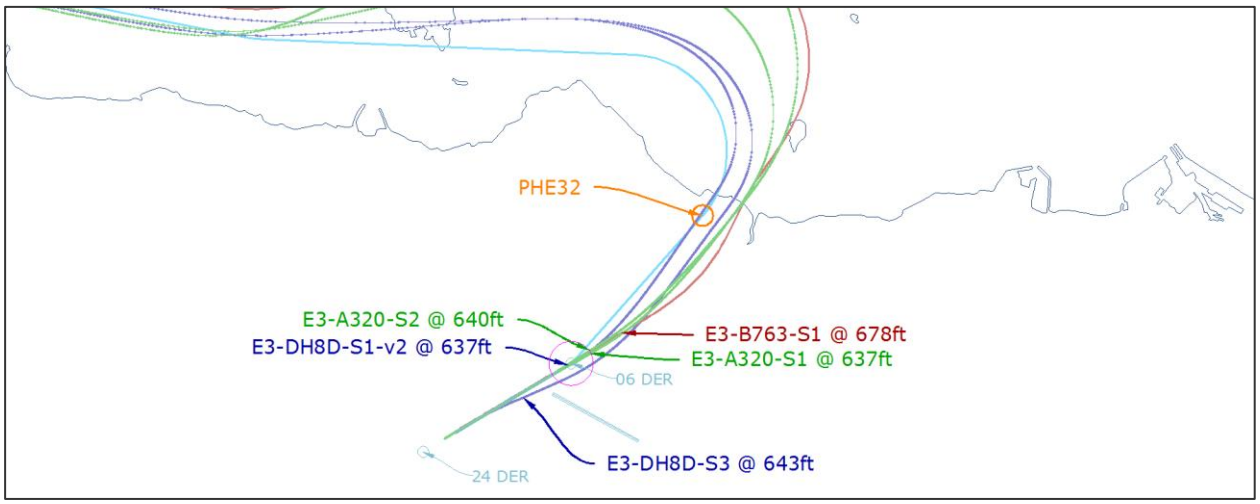


Figure 28: Route E Option 3 Tracks

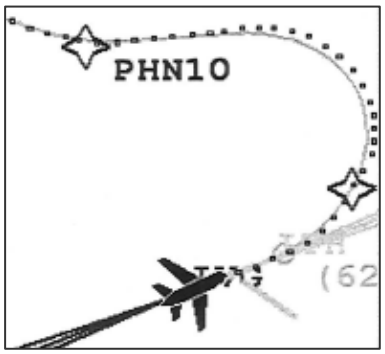


Figure 29: E3-B738-S1

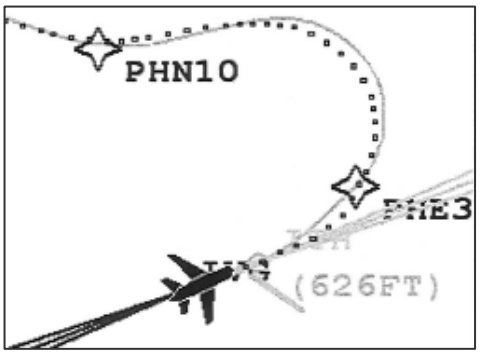


Figure 30: E3-B738-S2

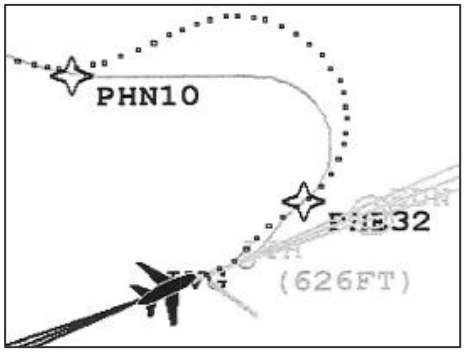


Figure 31: E3-B738-S3

These results show that, while the route is flyable for the B738 and DH8D, waypoint PHE32 is too close to the DER for some aircraft types to achieve, particularly in heavy weight conditions. This option is therefore not being taken forward for inclusion in the ACP.

6.16. Route E Option 4

This option was not part of the formal consultation. The intention was to construct a SID with a 20° offset to the left to try and improve the noise situation for Cramond. This procedure was not coded and was tested by manually modifying Route E Option 3 with a new waypoint.

Description:	Replacement for GOSAM 1D SID (Jet Only)		
Purpose:	Split southbound and westbound jets from eastbound jets and eastbound, southbound, and westbound non-jets using an early fly-over waypoint		
Aircraft Types:	A320, A330, B733, B738, B788, E170, E190		
	Scenario 1	**Scenario 2**	**Scenario 3**
Wind Direction:	Still	150°	360°
Wind Speed:	Still	30kts	30kts
Surface Temp:	15°C	25°C	-5°C
Pressure:	1013.2hPa	980hPa	1025hPa
Aircraft Weight:	MTOW	MTOW	Min TOW
Objective:	Base case climb performance	Can level restrictions be met in worst case climb conditions?	Are there any track keeping issues in best case climb conditions?
A320 Run ID:	N/A	E4-A320-S2	N/A
B738 Run ID:	N/A	E4-B738-S2	N/A
DH8D Run ID:	N/A	E4-DH8D-S2 *	N/A
B763 Run ID:	N/A	E4-B763-S2	N/A
Notes:	• Run can terminate once established on final leg • Assume climb clearance to FL300		

** Non-jets will not fly route E but if the simulator validation is successful we would want to implement the same 20° track adjustment for route F. If non-jets are able to fly Route E Option 4 then they should be able to fly the less demanding Route F.*

Runs Completed

	Scenario 1	**Scenario 2**	**Scenario 3**
A320 Run ID:	N/A	E4-A320-S2	N/A
B738 Run ID:	N/A	E4-B738-S2	N/A
DH8D Run ID:	N/A	E4-DH8D-S2	N/A
B763 Run ID:	N/A	E4-B763-S2	N/A

Results

	Acceptable	**Not Acceptable**	**Deferred**
A320:		Not Acceptable	
B738:	Acceptable		
DH8D:	Acceptable		
B763:			

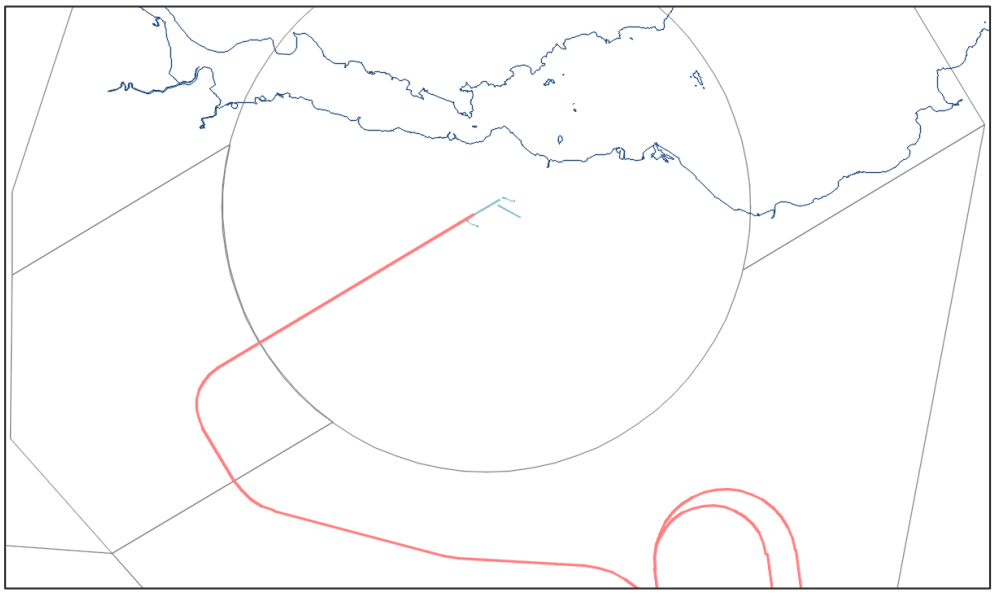
Observations

A320:	PHE99 not sequenced PHN10 not sequenced First 2 WP not sequenced
B738:	0.35NM cross track error leading to PHN10 0.35NM cross track error at PHN10
DH8D:	
B763:	

Findings (Sessions 1-8)

This route is a more challenging version of Route E Option 3. As Route E Option 3 is not being taken forward for inclusion in the ACP due to the flyability issues found, Route E Option 4 will not be taken forward for inclusion in the ACP either.

6.17. FAULD 1A (EDIBO 1B - EDIBO 1D) and ILS or RNAV(GNSS) Approach to Runway 06



Description:	New arrival transition to 12.9NM from threshold		
Purpose:	PBN Arrival Transition from hold to IF for ILS, LOC, or RNAV(GNSS) approach to runway 06		
Aircraft Types:	All		
	Scenario 1	**Scenario 2**	**Scenario 3**
Wind Direction:	Still	010°	150°
Wind Speed:	Still	30kts	30kts
Surface Temp:	15°C	-5°C	25°C
Pressure:	1013.2hPa	1025hPa	980hPa
Aircraft Weight:	Average	Min TOW	MTOW
Approach Type:	ILS	RNAV(GNSS)	RNAV(GNSS)
Objective:	Base case descent performance and RNAV to ILS validation	Worst case descent conditions and best case climb conditions	Best case descent conditions and worst case climb conditions
A320 Run ID:	06-A320-S1	06-A320-S2	06-A320-S3
B738 Run ID:	06-B738-S1	06-B738-S2	06-B738-S3
DH8D Run ID:	06-DH8D-S1	06-DH8D-S2	06-DH8D-S3
B763 Run ID:	06-B763-S1	06-B763-S2	06-B763-S3
Notes:	• Aircraft should leave the hold at FL90 • Assume unrestricted descent clearance • Scenario 1 can terminate once established on glide path • Scenarios 2 and 3 must be flown to end of missed approach		

Description:	New arrival transition to 12.9NM from threshold		
Purpose:	PBN Arrival Transition from hold to IF for ILS, LOC, or RNAV(GNSS) approach to runway 06		
Aircraft Types:	All		
	Scenario 4	**Scenario 5**	**Scenario 6**
Wind Direction:	010°	Still	150°
Wind Speed:	30kts	Still	30kts
Surface Temp:	-5°C	15°C	25°C
Pressure:	1025hPa	1013.2hPa	980hPa
Aircraft Weight:	Min TOW	Average	MTOW
Approach Type:	RNAV(GNSS)	ILS	RNAV (GNSS)
Starting Point:	PHW16	EDIBO	PHW16
Missed App'ch:	Yes	No	Yes
Objective:	Worst case descent conditions and best case climb conditions	Base case descent performance and RNAV to ILS validation	Best case descent conditions and worst case climb conditions
A320 Run ID:	06-A320-S4	06-A320-S5	06-A320-S6
Notes:	• Aircraft should leave the hold at FL90 • Assume unrestricted descent clearance • Scenario 5 can terminate once established on glide path • Scenarios 4 and 6 must be flown to end of missed approach		

Description:	New arrival transition to 12.9NM from threshold
Purpose:	PBN Arrival Transition from hold to IF for ILS, LOC, or RNAV(GNSS) approach to runway 06
Aircraft Types:	All
	Scenario 7
Wind Direction:	Still
Wind Speed:	Still
Surface Temp:	15°C
Pressure:	1013.2hPa
Aircraft Weight:	Average
Approach Type:	ILS Y
Starting Point:	EDIBO
Missed App'ch:	No
Objective:	RNAV to ILS validation
A320 Run ID:	06-A320-S7
B738 Run ID:	06-B738-S7
Notes:	• Aircraft should leave the hold at FL90 • Assume unrestricted descent clearance • Scenario 7 can terminate once established on glide path

Runs Completed

	Scenario 1	Scenario 2	Scenario 3
A320 Run ID:	06-A320-S1	06-A320-S2	06-A320-S3
B738 Run ID:	06-B738-S1	06-B738-S2	06-B738-S3
DH8D Run ID:	06-DH8D-S1	06-DH8D-S2	06-DH8D-S3
B763 Run ID:	06-B763-S1	06-B763-S2 *	06-B763-S3 *

** The B763 simulator could not fly RNAV approach procedures so scenarios 2 and 3 were flown with the ILS approach procedure instead.*

	Scenario 4	Scenario 5	Scenario 6
A320 Run ID:	06-A320-S4	06-A320-S5	06-A320-S6

	Scenario 7
A320 Run ID:	06-A320-S7
B738 Run ID:	06-B738-S7

Results

	Acceptable	Not Acceptable	Deferred
A320:	Acceptable		
B738:	Acceptable		
DH8D:	Acceptable		
B763:	Acceptable		

Observations

A320:	Sessions 1-8: Default behaviour on leaving the hold was to treat EDIBO as fly-over. However a "route direct" to EDIBO treated it as fly-by as intended. FL90 was too high to leave the hold and resulted in a steep descent. IF of ILS approach procedure wasn't named FAULD so FMS tried to sequence two waypoints in close proximity. This caused a disconnect and was therefore "not acceptable". Suggest creating "Y" and "Z" procedures, one for conventional reversals and one for RNAV transitions. Superfluous speed restrictions on the procedures which the FMS treated as "at" speeds and caused the aircraft to accelerate on leaving the hold. Inconsistent altitude restrictions at EDIBO. Session 9: Lack of transition from Base Leg to Localiser requires manual intervention from pilot. No problems for RNAV approach. Sessions 10-11: FMS behaviour as expected. Initial to FAF, slight mismatch, compared to FAT (ILS)
B738:	Higher workload than normal but within limits. (turning onto final & capturing ILS) Speed control and energy management tricky turning onto final, and capturing the glideslope. When stabilized on the VNAV profile, turning final, glide slope was a dot to a dot and a half high. Glide slope capture occurred just before 3000'. (FAP) Needed Flap 10 and speed brake on base.
DH8D:	None
B763:	250kts is very fast for holding – 220kts more likely. Treated EDIBO as fly-over when leaving the hold. Problem getting from FAULD to ILS, not initiating turn so have to manually go into heading mode. Removed 12.9 waypoint on ILS procedure and much better approach.

Findings (Sessions 1-8)

The ILS approach procedure will be revised with the IF named FAULD to link with the FAULD 1A transition. The coding table will be revised to show the speed restrictions as maximum speeds. This route will be taken forward for inclusion in the ACP.

Findings (Session 9)

The ILS approach procedure was revised with the IF named FAULD to link with the FAULD 1A transition. However it seems that the wrong ILS procedure was selected during the simulation so the run was done using the currently published ILS procedure instead.

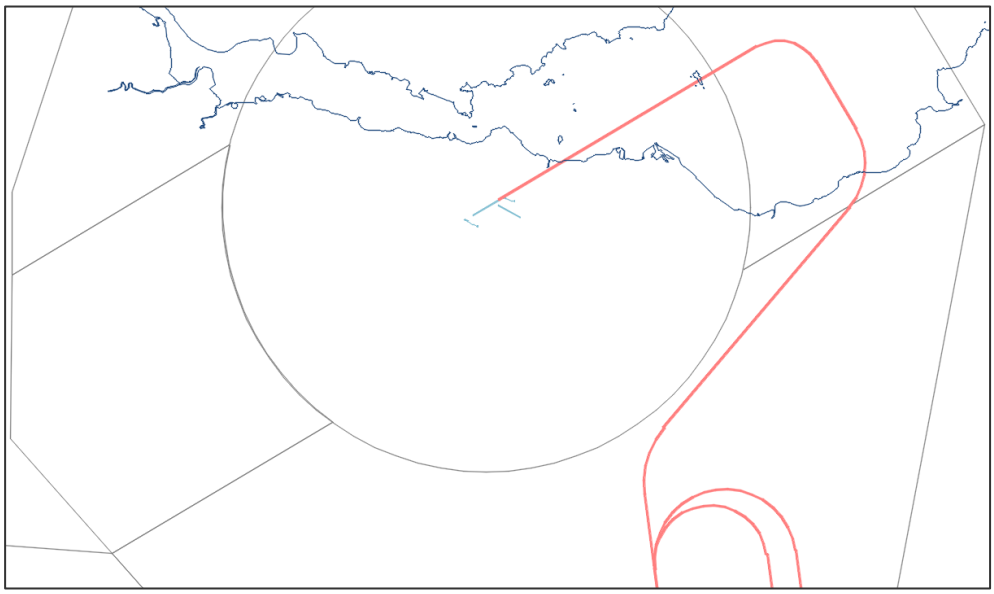
Findings (Sessions 10-11)

The A320 was able to load the EDIBO 1D transition and ILS Y approach to RWY 06 without a problem. The FMS sequenced from the transition to the approach properly but ended up placing the aircraft 0.2NM south of the LOC beam. The geodetic calculations for VETID have been rechecked and found to be correct. The discrepancy therefore seems to be with the simulator.

The B738 was able to load the EDIBO 1D transition without a problem but the ILS Y approach to RWY 06 could not be found in the FMS. The existing ILS approach to RWY 06 was therefore loaded instead and waypoint VETID was inserted manually. The aircraft then struggled with the speed and descent profile as it treated the speed restrictions as targets rather than limits. The FMS sequenced from the transition to the approach properly but was above the glideslope until just before the FAF.

The EDIBO 1D transition has been revised to reduce the speed to 185KIAS by ADLOM (turn onto base leg). The level restriction at VETID has also been updated to ensure aircraft are between 3000ft and 4000ft at VETID. This route will be taken forward for inclusion in the ACP.

6.18. FIRTH 1A (EDIBO 1A – EDIBO 1C) and ILS or RNAV(GNSS) Approach to Runway 24



Description:	New arrival transition to 12.9NM from threshold		
Purpose:	PBN Arrival Transition from hold to IF for ILS, LOC, or RNAV(GNSS) approach to runway 24		
Aircraft Types:	All		
	Scenario 1	**Scenario 2**	**Scenario 3**
Wind Direction:	Still	290°	330°
Wind Speed:	Still	30kts	30kts
Surface Temp:	15°C	-5°C	25°C
Pressure:	1013.2hPa	1025hPa	980hPa
Aircraft Weight:	Average	Min TOW	MTOW
Approach Type:	ILS	RNAV(GNSS)	RNAV(GNSS)
Missed App'ch:	No	Yes	Yes
Purpose:	Base case descent performance and RNAV to ILS validation	Worst case descent conditions and best case climb conditions	Best case descent conditions and worst case climb conditions
A320 Run ID:	24-A320-S1	24-A320-S2	24-A320-S3
B738 Run ID:	24-B738-S1	24-B738-S2	24-B738-S3
DH8D Run ID:	24-DH8D-S1	24-DH8D-S2	24-DH8D-S3
B763 Run ID:	24-B763-S1	24-B763-S2	24-B763-S3
Notes:	• Aircraft should leave the hold at FL90 • Assume unrestricted descent clearance • Scenario 1 can terminate once established on glide path • Scenarios 2 and 3 must be flown to end of missed approach		

Description:	New arrival transition to 12.9NM from threshold		
Purpose:	PBN Arrival Transition from hold to IF for ILS, LOC, or RNAV(GNSS) approach to runway 24		
Aircraft Types:	All		
	Scenario 4	**Scenario 5**	**Scenario 6**
Wind Direction:	290°	Still	330°
Wind Speed:	30kts	Still	30kts
Surface Temp:	-5°C	15°C	25°C
Pressure:	1025hPa	1013.2hPa	980hPa
Aircraft Weight:	Min TOW	Average	MTOW
Approach Type:	RNAV(GNSS)	ILS	RNAV (GNSS)
Starting Point:	PHE18	EDIBO	PHE18
Missed App'ch:	Yes	No	Yes
Objective:	Worst case descent conditions and best case climb conditions	Base case descent performance and RNAV to ILS validation	Best case descent conditions and worst case climb conditions
A320 Run ID:	24-A320-S4	24-A320-S5	24-A320-S6
Notes:	• Aircraft should leave the hold at FL90 • Assume unrestricted descent clearance • Scenario 5 can terminate once established on glide path • Scenario 4 must be flown to end of missed approach		

Description:	New arrival transition to 12.9NM from threshold
Purpose:	PBN Arrival Transition from hold to IF for ILS, LOC, or RNAV(GNSS) approach to runway 24
Aircraft Types:	All
	Scenario 7
Wind Direction:	Still
Wind Speed:	Still
Surface Temp:	15°C
Pressure:	1013.2hPa
Aircraft Weight:	Average
Approach Type:	ILS Y
Starting Point:	EDIBO
Missed App'ch:	No
Objective:	RNAV to ILS validation
A320 Run ID:	24-A320-S7
B738 Run ID:	24-B738-S7
Notes:	• Aircraft should leave the hold at FL90 • Assume unrestricted descent clearance • Scenario 7 can terminate once established on glide path

Runs Completed

	Scenario 1	Scenario 2	Scenario 3
A320 Run ID:	24-A320-S1	24-A320-S2	24-A320-S3
B738 Run ID:	24-B738-S1	24-B738-S2	24-B738-S3
DH8D Run ID:	24-DH8D-S1	24-DH8D-S2	24-DH8D-S3
B763 Run ID:	24-B763-S1	24-B763-S2 *	24-B763-S3 *

** The B763 simulator could not fly RNAV approach procedures so scenarios 2 and 3 were flown with the ILS approach procedure instead.*

	Scenario 4	Scenario 5	Scenario 6
A320 Run ID:	24-A320-S4	24-A320-S5	24-A320-S6

	Scenario 7
A320 Run ID:	24-A320-S7
B738 Run ID:	24-B738-S7

Results

	Acceptable	Not Acceptable	Deferred
A320:	Acceptable		
B738:	Acceptable		
DH8D:	Acceptable		
B763:	Acceptable		

Observations

A320:	Sessions 1-8: IF of ILS approach procedure wasn't named FIRTH so FMS tried to sequence two waypoints in close proximity. In this case the LOC was armed so the FMS captured the LOC but the issue still exists. Superfluous speed restrictions on the procedures which the FMS treated as "at" speeds and caused the aircraft to accelerate on leaving the hold. Inconsistent altitude restrictions at EDIBO. Session 9: Lack of transition from Base Leg to Localiser requires manual intervention from pilot. RNAV approaches worked well with approach transitions. Sessions 10-11: FAT not aligned with LOC (0.2L). Check course.
B738:	None
DH8D:	None
B763:	Removed waypoint 13 on ILS chart. Pilot notes that hold entry would be better South to North. Wrong hold/orientation might have been selected. Pilot notes that you would be vectored in much tighter than this so procedure might not be flown as often as it could with a shorter approach.

Findings (Sessions 1-8)

The ILS approach procedure will be revised with the IF named FIRTH to link with the FIRTH 1A transition. The coding table will be revised to show the speed restrictions as maximum speeds. This procedure will be taken forward for inclusion in the ACP.

Findings (Session 9)

The ILS approach procedure was revised with the IF named FIRTH to link with the FIRTH 1A transition. However it seems that the wrong ILS procedure was selected during the simulation so the run was done using the currently published ILS procedure instead.

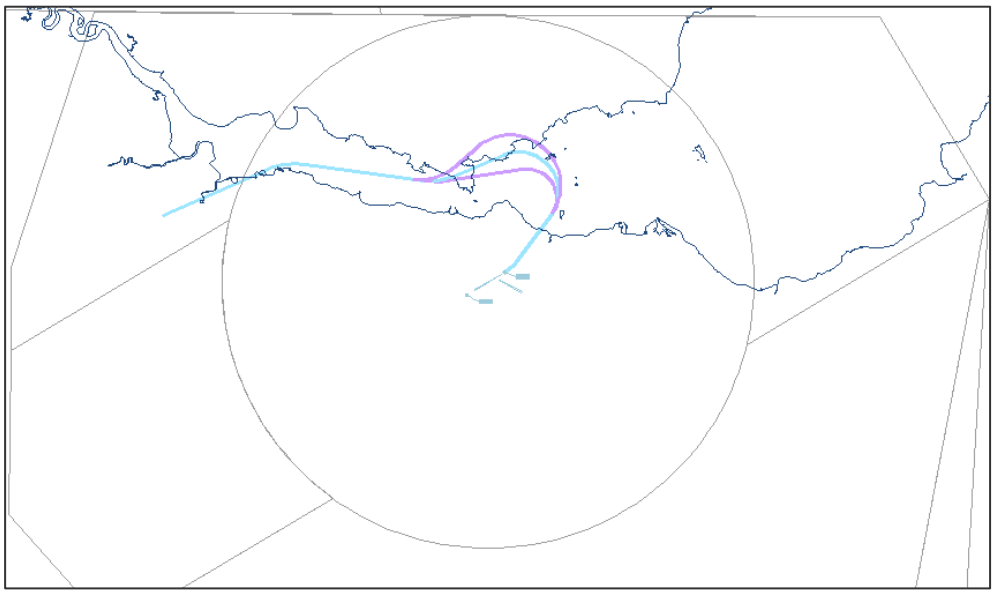
Findings (Sessions 10-11)

The A320 was able to load the EDIBO 1C transition and ILS Y approach to RWY 24 without a problem. The FMS sequenced from the transition to the approach properly but ended up placing the aircraft 0.2NM south of the LOC beam. The geodetic calculations for ABSEK have been rechecked and found to be correct. The discrepancy therefore seems to be with the simulator.

The B738 was able to load the EDIBO 1C transition without a problem but the ILS Y approach to RWY 24 could not be found in the FMS. The existing ILS approach to RWY 24 was therefore loaded instead and waypoint ABSEK was inserted manually. The FMS sequenced from the transition to the approach properly.

The EDIBO 1C transition has been revised to reduce the speed to 185KIAS by TRIAR (turn onto base leg). The level restriction at ABSEK has also been updated to ensure aircraft are between 3000ft and 4000ft at ABSEK. This route will be taken forward for inclusion in the ACP.

6.19. EMJEE 1U



Description:	Replacement for GOSAM 1D SID (Jet Only)		
Purpose:	Split southbound and westbound jets from eastbound jets and eastbound, southbound, and westbound non-jets using a fly-over waypoint at the DER followed by a DF leg		
Aircraft Types:	A320, A330, B733, B738, B788, E170, E190		
	Scenario 7	**Scenario 8**	**Scenario 9**
Wind Direction:	150°	Still	060°
Wind Speed:	30kts	Still	10kts
Surface Temp:	25°C	15°C	15°C
Pressure:	980hPa	1013.2hPa	1013.2hPa
Aircraft Weight:	MTOW	Average	Average
Objective:	Can level restrictions be met in worst case climb conditions?	Average conditions	Light headwind
A320 Run ID:	EU-A320-S7	EU-A320-S8	
B738 Run ID:	EU-B738-S7	EU-B738-S8	EU-B738-S9
Notes:	• Assume climb clearance to FL300		

Description:	Replacement for GOSAM 1D SID (Jet Only)		
Purpose:	Split southbound and westbound jets from eastbound jets and eastbound, southbound, and westbound non-jets using a fly-over waypoint at the DER followed by a DF leg		
Aircraft Types:	A320, A330, B733, B738, B788, E170, E190		
	Scenario 10	**Scenario 11**	**Scenario 12**
Wind Direction:	105°	105°	150°
Wind Speed:	20kts	20kts	30kts
Surface Temp:	15°C	15°C	15°C
Pressure:	1013.2hPa	1013.2hPa	1013.2hPa
Aircraft Weight:	Average	73.5T	73.5T
Objective:	Medium crosswind from 45° right	Medium crosswind from 45° right, fairly heavy	Strong crosswind from 90° right, fairly heavy
A320 Run ID:			
B738 Run ID:	EU-B738-S10	EU-B738-S11	EU-B738-S12
Notes:	• Assume climb clearance to FL300		

Description:	Replacement for GOSAM 1D SID (Jet Only)		
Purpose:	Split southbound and westbound jets from eastbound jets and eastbound, southbound, and westbound non-jets using a fly-over waypoint at the DER followed by a DF leg		
Aircraft Types:	A320, A330, B733, B738, B788, E170, E190		
	Scenario 13	**Scenario 14**	**Scenario 15**
Wind Direction:	015°	015°	150°
Wind Speed:	30kts	30kts	30kts
Surface Temp:	15°C	15°C	25°C
Pressure:	1013.2hPa	1013.2hPa	980hPa
Aircraft Weight:	73.5T	73.5T	MTOW
Objective:	Strong crosswind from 45° left, fairly heavy	Strong crosswind from 45° left, fairly heavy, delete waypoint PHN20	Strong crosswind from 90° right, very heavy, delete waypoint PHN20
A320 Run ID:			
B738 Run ID:	EU-B738-S13	EU-B738-S14	EU-B738-S15
Notes:	• Assume climb clearance to FL300		

Runs Completed

	Scenario 7	**Scenario 8**	**Scenario 9**
A320 Run ID:	EU-A320-S7	EU-A320-S8	
B738 Run ID:	EU-B738-S7	EU-B738-S8	EU-B738-S9

	Scenario 10	**Scenario 11**	**Scenario 12**
A320 Run ID:			
B738 Run ID:	EU-B738-S10	EU-B738-S11	EU-B738-S12

	Scenario 13	Scenario 14	Scenario 15
A320 Run ID:			
B738 Run ID:	EU-B738-S13	EU-B738-S14	EU-B738-S15

Results

	Acceptable	Not Acceptable	Deferred
A320:	Acceptable		
B738:	Acceptable		

Observations

A320:	None
B738:	Scenario 7: PHN11 not sequenced correctly Scenario 8: No problems Scenario 9: No problems Scenario 10: No problems Scenario 11: No problems Scenario 12: No problems Scenario 13: Bypassed PHN11 and PHN20 Scenario 14: Deleted PHN20 – worked Scenario 15: Deleted PHN20 – PHN11 bypassed but track better & it still actually sequenced the WP. Didn't have time to complete the turn to PHN11 before turning to intercept the next waypoint PHW13.

Findings (Sessions 10-11)

This was the preferred design for the EMJEE SID as it took aircraft furthest to the north of Cramond. The A320 didn't have any problems flying this procedure.

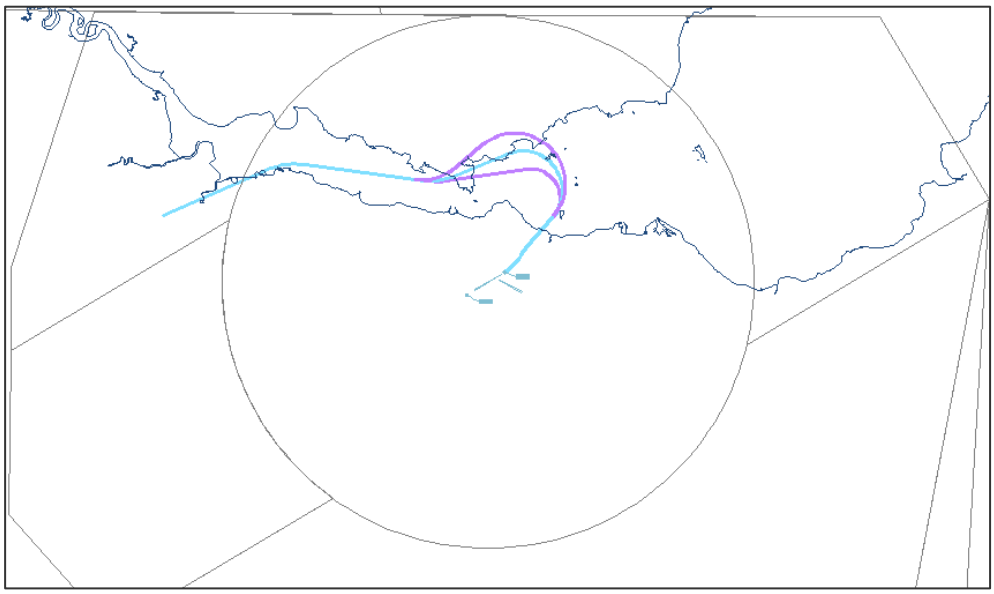
The B738 was able to fly the procedure in still wind conditions (scenario 8) but wasn't able to sequence waypoint PHN11 correctly in the cross-wind conditions (scenario 7). We therefore tested this procedure in a number of additional scenarios to identify what the conditions were that caused the problem and whether the issues could be addressed.

The sequencing issue returned in scenario 13 which had a strong crosswind from the left and an aircraft weight of 73.5T. On this run the aircraft bypassed both PHN11 and PHN20. The aircraft seemed to be bypassing PHN11 in order to try and intercept the track from PHN11 to PHN20 but was failing to establish on the track before reaching PHN20.

Scenario 14 used the same conditions as scenario 13 but waypoint PHN20 was deleted. This time the aircraft flew the procedure properly. Scenario 15 then used the same conditions as scenario 07 but waypoint PHN20 was deleted. On this run waypoint PHN11 was bypassed but the track was much better and waypoint PHN11 was sequenced.

The EMJEE 1U coding has been incorporated into the EMJEE 1D and GRICE 5D SIDs. For EMJEE 1D waypoint PHN20 has been removed. The revised coding will be taken forward for inclusion in the ACP as part of the EMJEE 1D and GRICE 5D SIDs.

6.20. EMJEE 1V



Description:	Replacement for GOSAM 1D SID (Jet Only)	
Purpose:	Split southbound and westbound jets from eastbound jets and eastbound, southbound, and westbound non-jets using a fly-over waypoint at the DER followed by an 18° offset CF leg	
Aircraft Types:	A320, A330, B733, B738, B788, E170, E190	
	Scenario 7	**Scenario 8**
Wind Direction:	150°	Still
Wind Speed:	30kts	Still
Surface Temp:	25°C	15°C
Pressure:	980hPa	1013.2hPa
Aircraft Weight:	MTOW	Average
Objective:	Can level restrictions be met in worst case climb conditions?	Average conditions
A320 Run ID:	EV-A320-S7	EV-A320-S8
B738 Run ID:	EV-B738-S7	EV-B738-S8
Notes:	• Assume climb clearance to FL300	

Runs Completed

	Scenario 7	**Scenario 8**
A320 Run ID:	EV-A320-S7	EV-A320-S8
B738 Run ID:	EV-B738-S7	EV-B738-S8

Results

	Acceptable	Not Acceptable	Deferred
A320:	Acceptable		
B738:	Acceptable		

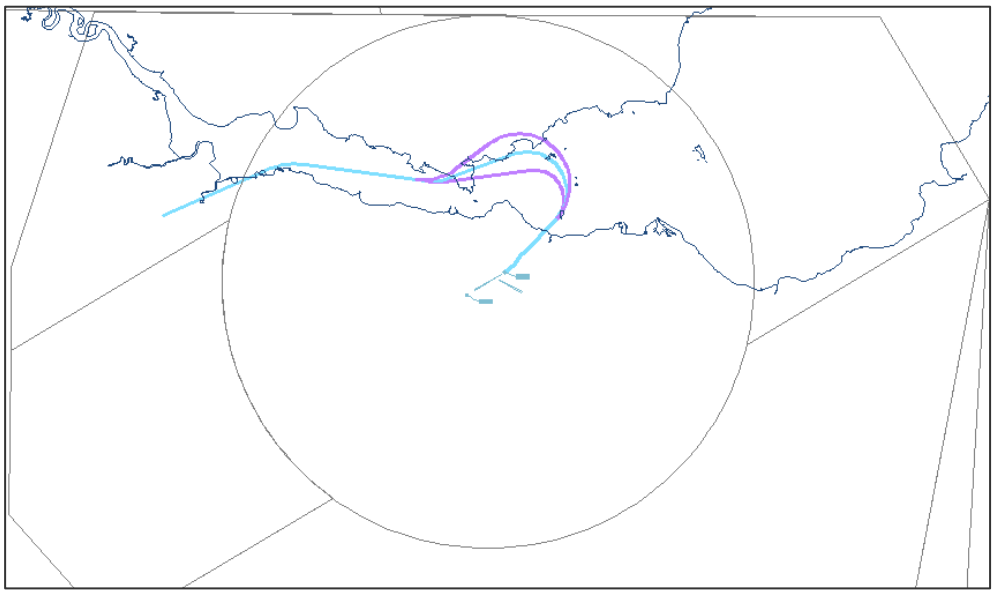
Observations

A320:	None
B738:	PHN11 – Bypassed Acceptable given conditions and caveat of removing PHN20 could improve performance and tracking.

Findings (Sessions 10-11)

No changes are required, however this route is not being taken forward as EMJEE 1U was preferred based on distance from Cramond.

6.21. EMJEE 1W



Description:	Replacement for GOSAM 1D SID (Jet Only)	
Purpose:	Split southbound and westbound jets from eastbound jets and eastbound, southbound, and westbound non-jets using a fly-over waypoint at the DER followed by a 15° offset CF leg	
Aircraft Types:	A320, A330, B733, B738, B788, E170, E190	
	Scenario 7	**Scenario 8**
Wind Direction:	150°	Still
Wind Speed:	30kts	Still
Surface Temp:	25°C	15°C
Pressure:	980hPa	1013.2hPa
Aircraft Weight:	MTOW	Average
Objective:	Can level restrictions be met in worst case climb conditions?	Average conditions
A320 Run ID:	EW-A320-S7	EW-A320-S8
B738 Run ID:	EW-B738-S7	EW-B738-S8
Notes:	• Assume climb clearance to FL300	

Runs Completed

	Scenario 7	**Scenario 8**
A320 Run ID:	EW-A320-S7	EW-A320-S8
B738 Run ID:	EW-B738-S7	EW-B738-S8

Results

	Acceptable	Not Acceptable	Deferred
A320:	Acceptable		
B738:	Acceptable		

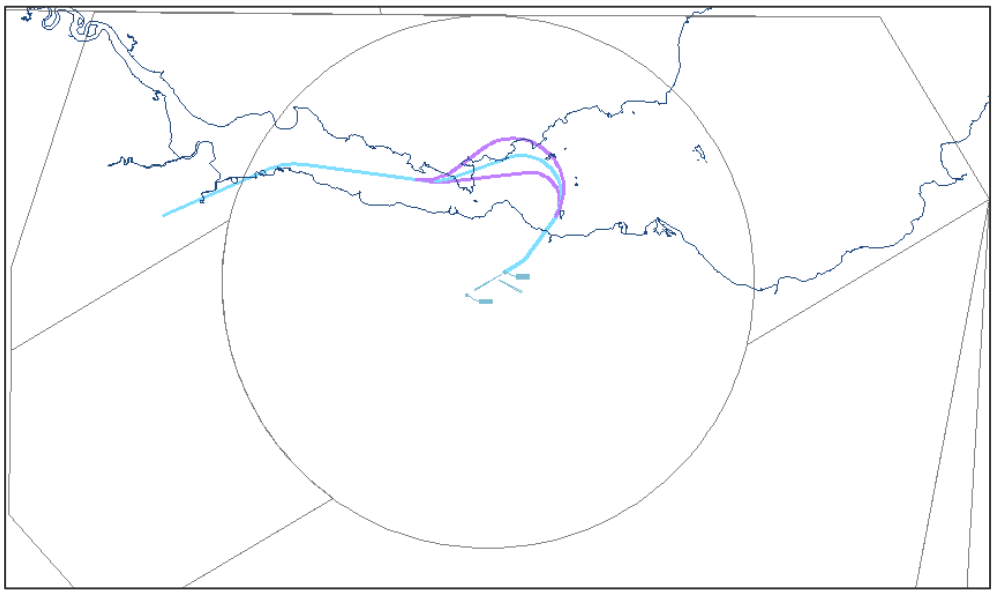
Observations

A320:	None
B738:	Behaved slightly differently at PHN11 – executed better, though still bypassed. Removing PHN20 or displacing it further from PHN11 will improve performance and tracking.

Findings (Sessions 10-11)

No changes are required, however this route is not being taken forward as EMJEE 1U was preferred based on distance from Cramond.

6.22. EMJEE 1X



Description:	Replacement for GOSAM 1D SID (Jet Only)	
Purpose:	Split southbound and westbound jets from eastbound jets and eastbound, southbound, and westbound non-jets using a fly-over waypoint 0.5NM after the DER followed by a DF leg	
Aircraft Types:	A320, A330, B733, B738, B788, E170, E190	
	Scenario 7	**Scenario 8**
Wind Direction:	150°	Still
Wind Speed:	30kts	Still
Surface Temp:	25°C	15°C
Pressure:	980hPa	1013.2hPa
Aircraft Weight:	MTOW	Average
Objective:	Can level restrictions be met in worst case climb conditions?	Average conditions
A320 Run ID:	EX-A320-S7	EX-A320-S8
B738 Run ID:	EX-B738-S7	EX-B738-S8
Notes:	• Assume climb clearance to FL300	

Runs Completed

	Scenario 7	**Scenario 8**
A320 Run ID:	EX-A320-S7	EX-A320-S8
B738 Run ID:	EX-B738-S7	EX-B738-S8

Results

	Acceptable	Not Acceptable	Deferred
A320:	Acceptable		
B738:	Acceptable		

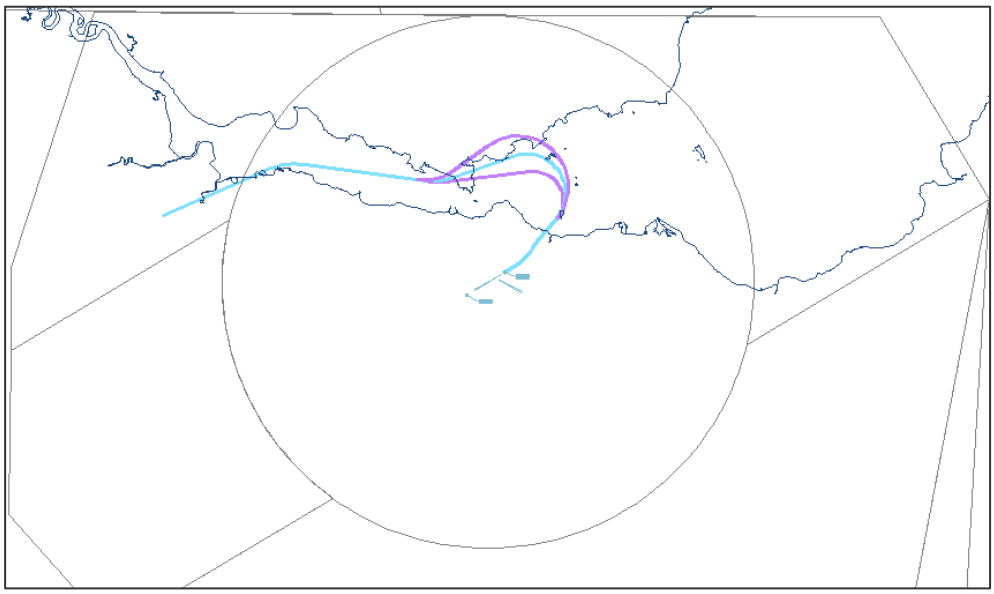
Observations

A320:	None
B738:	PHN20 bypassed – (due wide turn @ PHN11) PHN11 bypassed but better than previous runs Removing PHN20 or displacing it further from PHN11 will improve performance and tracking.

Findings (Sessions 10-11)

No changes are required, however this route is not being taken forward as EMJEE 1U was preferred based on distance from Cramond.

6.23. EMJEE 1Y



Description:	Replacement for GOSAM 1D SID (Jet Only)	
Purpose:	Split southbound and westbound jets from eastbound jets and eastbound, southbound, and westbound non-jets using a fly-over waypoint 0.5NM after the DER followed by an 18° offset CF leg	
Aircraft Types:	A320, A330, B733, B738, B788, E170, E190	
	Scenario 7	**Scenario 8**
Wind Direction:	150°	Still
Wind Speed:	30kts	Still
Surface Temp:	25°C	15°C
Pressure:	980hPa	1013.2hPa
Aircraft Weight:	MTOW	Average
Objective:	Can level restrictions be met in worst case climb conditions?	Average conditions
A320 Run ID:	EY-A320-S7	EY-A320-S8
B738 Run ID:	EY-B738-S7	EY-B738-S8
Notes:	• Assume climb clearance to FL300	

Runs Completed

	Scenario 7	**Scenario 8**
A320 Run ID:	EY-A320-S7	EY-A320-S8
B738 Run ID:	EY-B738-S7	EY-B738-S8

Results

	Acceptable	Not Acceptable	Deferred
A320:			
B738:	Acceptable		

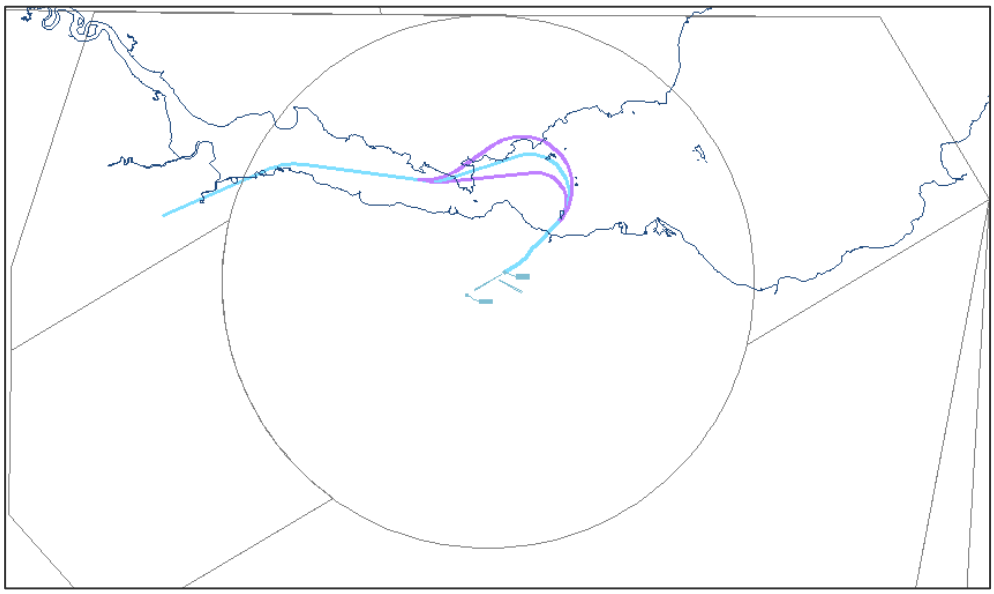
Observations

A320:	
B738:	PHN20 bypassed. PHN11 ok this time. Removing PHN20 or displacing it further from PHN11 will improve performance and tracking.

Findings (Sessions 10-11)

This route was not flown by the A320 aircraft. This route is not being taken forward as EMJEE 1U was preferred based on distance from Cramond.

6.24. EMJEE 1Z



Description:	Replacement for GOSAM 1D SID (Jet Only)	
Purpose:	Split southbound and westbound jets from eastbound jets and eastbound, southbound, and westbound non-jets using a fly-over waypoint 0.5NM after the DER followed by a 15° offset CF leg	
Aircraft Types:	A320, A330, B733, B738, B788, E170, E190	
	Scenario 7	**Scenario 8**
Wind Direction:	150°	Still
Wind Speed:	30kts	Still
Surface Temp:	25°C	15°C
Pressure:	980hPa	1013.2hPa
Aircraft Weight:	MTOW	Average
Objective:	Can level restrictions be met in worst case climb conditions?	Average conditions
A320 Run ID:	EZ-A320-S7	EZ-A320-S8
B738 Run ID:	EZ-B738-S7	EZ-B738-S8
Notes:	• Assume climb clearance to FL300	

Runs Completed

	Scenario 7	**Scenario 8**
A320 Run ID:	EZ-A320-S7	EZ-A320-S8
B738 Run ID:	EZ-B738-S7	EZ-B738-S8

Results

	Acceptable	Not Acceptable	Deferred
A320:			
B738:			

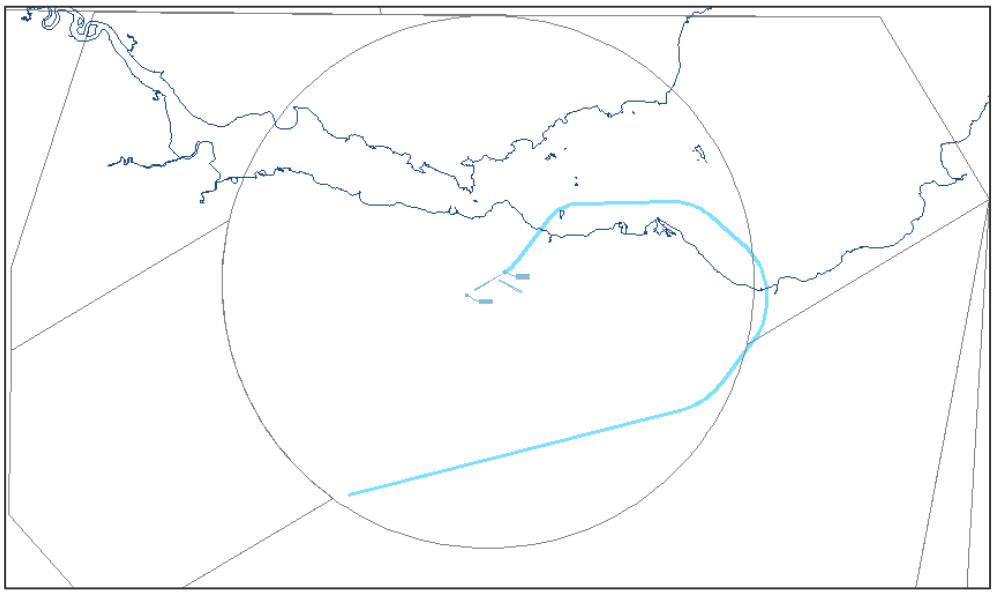
Observations

A320:
B738:

Findings (Sessions 10-11)

This route was not flown by either of the aircraft. This route is not being taken forward as EMJEE 1U was preferred based on distance from Cramond.

6.25. KRAGY 1U



Description:	Replacement for TALLA 6D SID (Non-Jet Only)	
Purpose:	For departure from runway 06 to the south via TALLA, non-jets from 0600-2259 all aircraft types 2300-0559, using a fly-over waypoint at the DER followed by a DF leg	
Aircraft Types:	AT76, D328, DH8D	
	Scenario 7	**Scenario 8**
Wind Direction:	330°	Still
Wind Speed:	30kts	Still
Surface Temp:	25°C	15°C
Pressure:	980hPa	1013.2hPa
Aircraft Weight:	MTOW	Average
Objective:	Can level restrictions be met in worst case climb conditions	Average conditions
A320 Run ID:	KU-A320-S7	KU-A320-S8
B738 Run ID:	KU-B738-S7	KU-B738-S8
Notes:	• Assume climb clearance to FL240	

Runs Completed

	Scenario 7	**Scenario 8**
A320 Run ID:	KU-A320-S7	KU-A320-S8
B738 Run ID:	KU-B738-S7	KU-B738-S8

Results

	Acceptable	Not Acceptable	Deferred
A320:	Acceptable		
B738:	Acceptable		

Observations

A320:	None
B738:	No problems.

Findings (Sessions 10-11)

This was the preferred design for the KRAGY SID as it took aircraft furthest to the north of Cramond. Neither aircraft had any problems flying this procedure.

There had been some concern about the ability of the FMS to manage the level restriction at PHE29 given that the bottom of the altitude window was expressed as an altitude and the top of the altitude window was expressed as a flight level. This was discussed with the pilots of both aircraft. None of the pilots had any concerns about this aspect of the procedure.

According to the pilots the FMS does all of its altitude calculations based on standard pressure. When it has to consider a level restriction expressed as an altitude, it just uses the current QNH to convert the altitude into a flight level. When the aircraft is on the runway it is therefore aware of the vertical performance required to meet both the “at or above 4000” and “at or below FL80” restrictions.

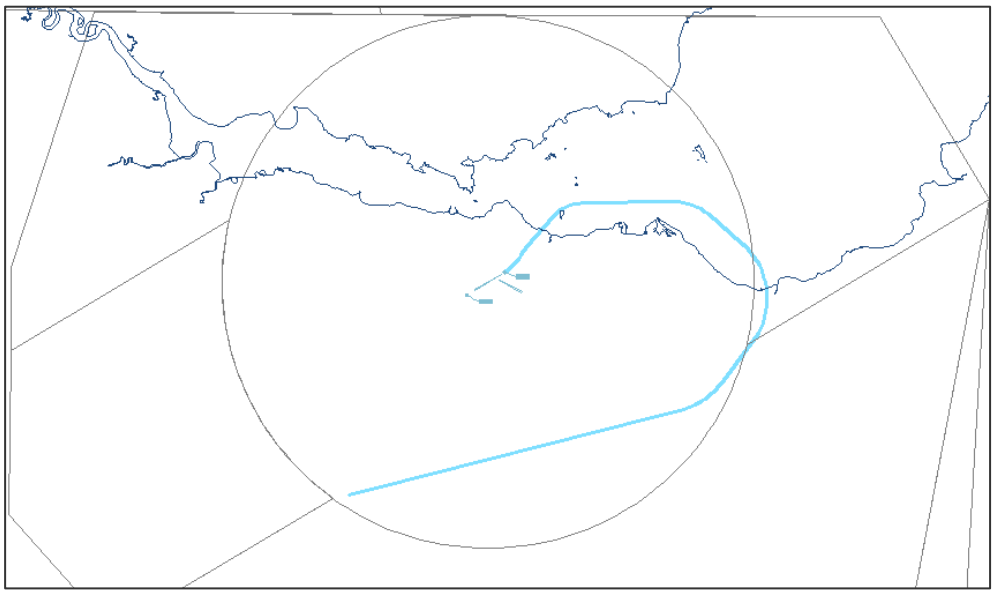
The pilots typically keep the altimeters set to QNH until the aircraft is above 1000ft and they are confident that they will achieve any altitude based level restrictions. Neither the “at or above 3000” restriction at PHE28 or the “at or above 4000” restriction at PHE29 require a particularly high climb gradient. The pilots therefore felt comfortable switching to standard pressure shortly after passing 1000ft.

The FMS successfully enforced the “at or below FL80” restriction at PHE29 in all cases. On some runs the climb profile of the aircraft meant that it passed PHE29 below FL80 anyway. However on other runs the aircraft climb profile meant that it reached FL80 between PHE28 and PHE29 and the aircraft automatically stopped its climb until it had passed PHE29.

It should be noted that even if the pilots hadn’t changed from QNH to standard pressure before reaching PHE29, the FMS would still have enforced the “at or below FL80” level restriction as it is always calculating the vertical pressure based on standard pressure. The FMS would simply have ensured that the aircraft didn’t climb above the altitude equivalent of FL80 (based on the currently set QNH) until it had passed PHE29.

The KRAGY 1U coding has been incorporated into the VOSNE 1D and KRAGY 1D SIDs. The revised coding will be taken forward for inclusion in the ACP as part of the VOSNE 1D and KRAGY 1D SIDs

6.26. KRAGY 1V



Description:	Replacement for TALLA 6D SID (Non-Jet Only)	
Purpose:	For departure from runway 06 to the south via TALLA, non-jets from 0600-2259 all aircraft types 2300-0559, using a fly-over waypoint at the DER followed by an 18° offset CF leg	
Aircraft Types:	AT76, D328, DH8D	
	Scenario 7	**Scenario 8**
Wind Direction:	330°	Still
Wind Speed:	30kts	Still
Surface Temp:	25°C	15°C
Pressure:	980hPa	1013.2hPa
Aircraft Weight:	MTOW	Average
Objective:	Can level restrictions be met in worst case climb conditions	Average conditions
A320 Run ID:	KV-A320-S7	KV-A320-S8
B738 Run ID:	KV-B738-S7	KV-B738-S8
Notes:	• Assume climb clearance to FL240	

Runs Completed

	Scenario 7	**Scenario 8**
A320 Run ID:	KV-A320-S7	KV-A320-S8
B738 Run ID:	KV-B738-S7	KV-B738-S8

Results

	Acceptable	Not Acceptable	Deferred
A320:	Acceptable		
B738:	Acceptable		

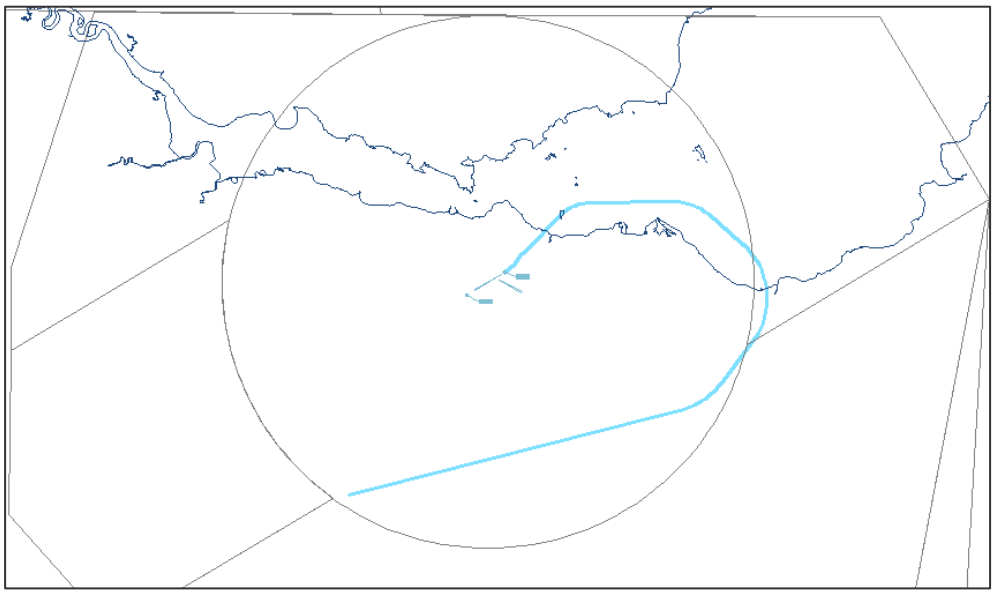
Observations

A320:	None
B738:	No problems.

Findings (Sessions 10-11)

No changes are required, however this route is not being taken forward as KRAGY 1U was preferred based on distance from Cramond.

6.27. KRAGY 1W



Description:	Replacement for TALLA 6D SID (Non-Jet Only)	
Purpose:	For departure from runway 06 to the south via TALLA, non-jets from 0600-2259 all aircraft types 2300-0559, using a fly-over waypoint at the DER followed by a 15° offset CF leg	
Aircraft Types:	AT76, D328, DH8D	
	Scenario 7	**Scenario 8**
Wind Direction:	330°	Still
Wind Speed:	30kts	Still
Surface Temp:	25°C	15°C
Pressure:	980hPa	1013.2hPa
Aircraft Weight:	MTOW	Average
Objective:	Can level restrictions be met in worst case climb conditions	Average conditions
A320 Run ID:	KW-A320-S7	KW-A320-S8
B738 Run ID:	KW-B738-S7	KW-B738-S8
Notes:	• Assume climb clearance to FL240	

Runs Completed

	Scenario 7	**Scenario 8**
A320 Run ID:	KW-A320-S7	KW-A320-S8
B738 Run ID:	KW-B738-S7	KW-B738-S8

Results

	Acceptable	Not Acceptable	Deferred
A320:	Acceptable		
B738:		Not Acceptable	

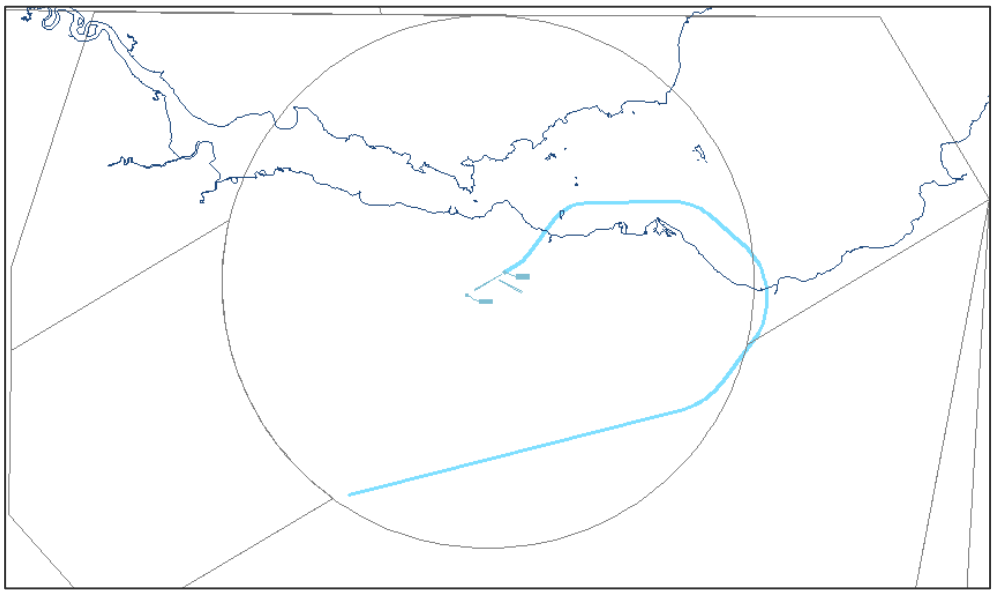
Observations

A320:	None
B738:	PHE12 bypassed.

Findings (Sessions 10-11)

This route was found to be Acceptable by the A320 but Not Acceptable by the B738. This route is not being taken forward as KRAGY 1U was preferred based on distance from Cramond.

6.28. KRAGY 1X



Description:	Replacement for TALLA 6D SID (Non-Jet Only)	
Purpose:	For departure from runway 06 to the south via TALLA, non-jets from 0600-2259 all aircraft types 2300-0559, using a fly-over waypoint 0.5NM after the DER followed by a DF leg	
Aircraft Types:	AT76, D328, DH8D	
	Scenario 7	**Scenario 8**
Wind Direction:	330°	Still
Wind Speed:	30kts	Still
Surface Temp:	25°C	15°C
Pressure:	980hPa	1013.2hPa
Aircraft Weight:	MTOW	Average
Objective:	Can level restrictions be met in worst case climb conditions	Average conditions
A320 Run ID:	KX-A320-S7	KX-A320-S8
B738 Run ID:	KX-B738-S7	KX-B738-S8
Notes:	• Assume climb clearance to FL240	

Runs Completed

	Scenario 7	**Scenario 8**
A320 Run ID:	KX-A320-S7	KX-A320-S8
B738 Run ID:	KX-B738-S7	KX-B738-S8

Results

	Acceptable	Not Acceptable	Deferred
A320:	Acceptable		
B738:	Acceptable		

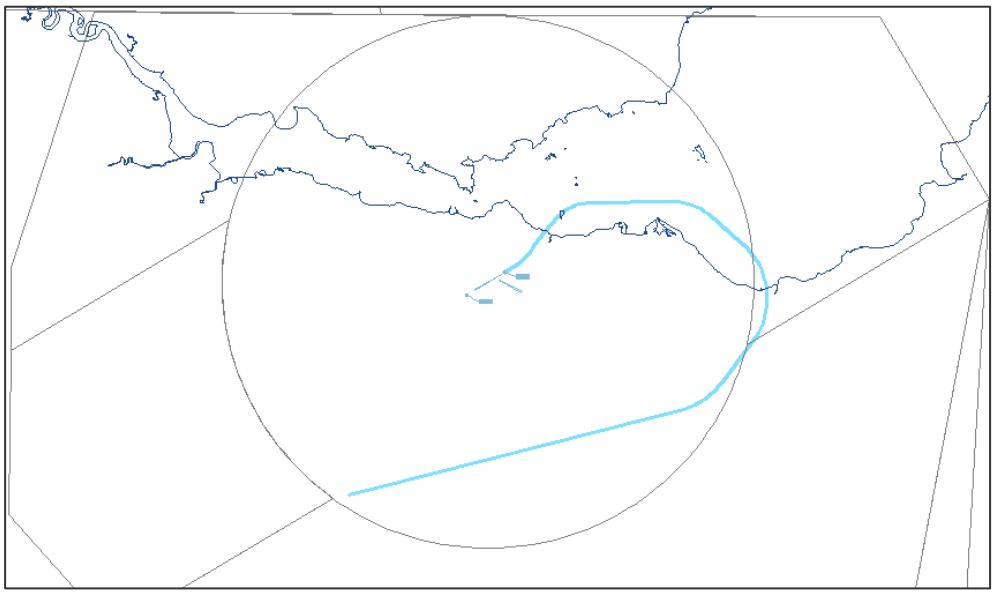
Observations

A320:	None
B738:	No problems.

Findings (Sessions 10-11)

No changes are required, however this route is not being taken forward as KRAGY 1U was preferred based on distance from Cramond.

6.29. KRAGY 1Y



Description:	Replacement for TALLA 6D SID (Non-Jet Only)	
Purpose:	For departure from runway 06 to the south via TALLA, non-jets from 0600-2259 all aircraft types 2300-0559, using a fly-over waypoint 0.5NM after the DER followed by an 18° offset CF leg	
Aircraft Types:	AT76, D328, DH8D	
	Scenario 7	**Scenario 8**
Wind Direction:	330°	Still
Wind Speed:	30kts	Still
Surface Temp:	25°C	15°C
Pressure:	980hPa	1013.2hPa
Aircraft Weight:	MTOW	Average
Objective:	Can level restrictions be met in worst case climb conditions	Average conditions
A320 Run ID:	KY-A320-S7	KY-A320-S8
B738 Run ID:	KY-B738-S7	KY-B738-S8
Notes:	• Assume climb clearance to FL240	

Runs Completed

	Scenario 7	**Scenario 8**
A320 Run ID:	KY-A320-S7	KY-A320-S8
B738 Run ID:	KY-B738-S7	KY-B738-S8

Results

	Acceptable	Not Acceptable	Deferred
A320:			
B738:		Not Acceptable	

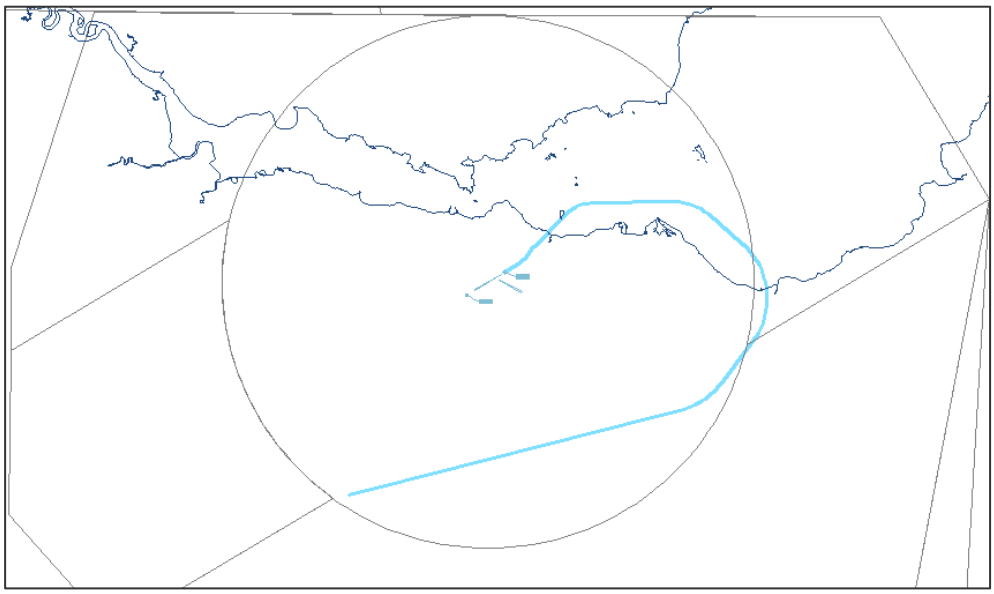
Observations

A320:	
B738:	PHE45 bypassed.

Findings (Sessions 10-11)

This route was not flown by the A320 aircraft. This route is not being taken forward as KRAGY 1U was preferred based on distance from Cramond.

6.30. KRAGY 1Z



Description:	Replacement for TALLA 6D SID (Non-Jet Only)	
Purpose:	For departure from runway 06 to the south via TALLA, non-jets from 0600-2259 all aircraft types 2300-0559, using a fly-over waypoint 0.5NM after the DER followed by a 15° offset CF leg	
Aircraft Types:	AT76, D328, DH8D	
	Scenario 7	**Scenario 8**
Wind Direction:	330°	Still
Wind Speed:	30kts	Still
Surface Temp:	25°C	15°C
Pressure:	980hPa	1013.2hPa
Aircraft Weight:	MTOW	Average
Objective:	Can level restrictions be met in worst case climb conditions	Average conditions
A320 Run ID:	KZ-A320-S7	KZ-A320-S8
B738 Run ID:	KZ-B738-S7	KZ-B738-S8
Notes:	• Assume climb clearance to FL240	

Runs Completed

	Scenario 7	**Scenario 8**
A320 Run ID:	KZ-A320-S7	KZ-A320-S8
B738 Run ID:	KZ-B738-S7	KZ-B738-S8

Results

	Acceptable	Not Acceptable	Deferred
A320:			
B738:			

Observations

A320:
B738:

Findings (Sessions 10-11)

This route was not flown by either of the aircraft. This route is not being taken forward as KRAGY 1U was preferred based on distance from Cramond.

7. Conclusions

The table below summarises the results of the simulator validation sessions and lists what actions will be taken in order to address any issues raised.

		A320	B738	DH8D	B763	Action
Route A	EVTOL 1C					No changes required
Route A2	ARLER 1C					No changes required
Route B1	MAVIX 1C					No changes required
Route B2	LIKLA 1C					No changes required
Route C	GRICE 4C					No changes required
Route D Opt. 1	VOSNE 1C					No changes required
Route D Opt. 2						This route is not being taken forward
Route E Opt. 1						This route is not being taken forward
Route E Opt. 2	EMJEE 1D					No changes required
Route F Opt. 1						This route is not being taken forward
Route F Opt. 2	GRICE 5D					No changes required
Route G	VOSNE 1D					No changes required
Route H1	KRAGY 1D					No changes required
Route H2						This route is not being taken forward
Route E Opt. 3						This route is not being taken forward
Route E Opt. 4						This route is not being taken forward
RWY 06	EDIBO 1D					No changes required
RWY 24	EDIBO 1C					No changes required