Birmingham Airport Airspace Change Proposal

Redesign of Northbound R-NAV Standard Instrument Departure (SIDs) procedures for Runway 15

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1. Introduction

In 2013 Birmingham Airport Limited (BAL) formally submitted its Airspace Change Proposal (ACP) for the implementation of new Standard Instrument Departure (SIDs) procedures for aircraft departing from Runway 15. In total six new SIDs were submitted, four of these deliver aircraft to 'southbound' destinations and are known as the '2Y' SIDs. The remaining two SIDs deliver aircraft to northbound destinations, these SIDs are known as the '1L' SIDs.

In April 2016 the Civil Aviation Authority (CAA) published its decision with a document entitled CAP1398 Birmingham International Airport standard instrument departures from Runway 15: CAA decision. In its decision, the CAA approved the southbound (2Y) SIDs. However, owing to significant dispersion of aircraft around the turn for the northbound TNT 1L and WHI 1L SIDs, the CAA required BAL to re-design the SIDs in order to improve concentration.

The CAA document is quoted as follows:

"BAL is to re-design the originally submitted northbound SIDs from runway 15 (Option 4) to resolve the track keeping performance such that traffic tracks closer to the nominal track and away from the north side of Balsall Common (as originally proposed and consulted upon).

Once the designs have been completed the CAA will assess whether the re designs require a new consultation. The CAA will then consider whether to approve that element of this airspace change proposal that relates to the northbound SIDs".

It should be noted that the dispersion around the northbound turn was acknowledged by BAL and a commitment was pledged with local stakeholders to improve concentration on this turn.

This report details the actions taken by BAL to address the above requirements and is the formal submission of a new SID to replace the TNT 1L and WHI 1L SIDs.

2. Background

Following the implementation of the '1L' SIDs in May 2014 (in a trial status) it was quickly identified that there was greater dispersion around the nominal SID centreline than

anticipated. This can be seen in the track plots from BALs Noise and Track-keeping (NTK) system in Appendix A.

As an immediate action BAL worked with Air Traffic Control (ATC) in order to understand whether ATC vectoring could be contributing to the dispersion observed. This was of interest as aircraft departing from runway 15 on a northbound heading are vectored through a 'gate' in the vicinity of Lichfield in order to maintain separation with East Midlands Airport. This investigation involved a short trial whereby aircraft were not vectored through the gate. The trial was found to have no impact on the level of dispersion which begins before vectoring takes place.

Further to this BAL also undertook detailed analysis in order to understand the make up of the dispersion and to identify if any trends could be observed. This analysis identified that Q400 turbo-prop and Boeing 757-200 (B752) aircraft were turning wider than anticipated. As a consequence, these aircraft were either flying closer to, or directly overflying the communities of Barston and Balsall Common. The Q400 makes up approximately 49% of departures heading north from runway 15 whilst the B752 aircraft makes up 3%. This dispersion can be seen in Appendix B. It should be noted that at the time of implementation there were considerably more B572 aircraft operating on the '1L' SIDs, however many of these Airlines are no longer operating at Birmingham Airport.

Flybe provided considerable time and resource to BAL in order to further understand the issue, which included their support for an interim solution (see section 3). Flybe's investigation found that the likely reasoning for the Q400 undertaking a wider radius in the turn was due to the interpretation of the SID coding by the FMS along with the performance characteristics of the turbo-prop. In addition to this Flybe provided significant input and resource when making the technical amendments to the design (see section 4).

It was also identified that the Boeing 787 (B787) aircraft has a wide dispersion of tracks flown on departure. As a result, it will on occasions fly closer to the communities of both Hampton-in-Arden, Barston and Balsall Common than intended. Tracks flown by this aircraft type can be seen in Appendix C and make up 1% of departures on this route. Whilst this is a relatively modest percentage BAL understands that this larger aircraft type is of particular annoyance to the community of Hampton-in-Arden.

Following discussion with the predominant operator of this aircraft type it was identified that the coding of the '1L' SIDs in the aircrafts Flight Management System (FMS), coupled with the performance characteristics of the aircraft was the cause of the dispersion observed.

BAL appointed NATS Procedure Design Group (PDG) as its procedure designers in June 2016 to re-design the northbound SIDs with the primary aim to improve concentration on the nominal SID centreline by all aircraft types. This is discussed in detail in Section 4.

3. Interim Solution

At the time of implementation of the RNAV-1 SIDs BAL also took the decision to implement a new conventional SID (predicated upon ground-based radio beacons) in order to service the modest number of Non-RNAV equipped aircraft operating at the time. As such the TNT 6E SID was implemented, which followed the same track as the RNAV-1 equivalent. Following consultation with Flybe, the major operator of the Q400 aircraft at Birmingham Airport it was agreed that a trial would take place for aircraft that otherwise use a TNT 1L RNAV-1 SID to instead file the TNT 6E Conventional SID.

This trial identified that whilst there was still some dispersion around the nominal SID centreline it successfully moved aircraft to the north of Balsall Common and to the east of Barston, reducing the overflight of these communities. It was therefore agreed that Flybe's, Q400 aircraft departing from runway 15 that normally use the TNT1L SID would instead file the TNT6E SID. This continues to be the case today and tracks flown by Q400 aircraft on the TNT 6E SID can be seen in Appendix D.

It should be noted that BAL undertook extensive engagement with other operators using B752 and B787 aircraft in order to encourage uptake of the TNT6E SID. However, most of these operators use the WHI1L SID and therefore the TNT6E SID would not fit within their flight planning and would also come at a significant fuel burn penalty.

4. Overview of the re-designed SIDs

4.1 Design objectives

BAL appointed NATS Procedure Design Group (PDG) in June 2016 to re-design the northbound SIDs with the primary aim to improve concentration on the nominal SID centreline for all aircraft types.

In developing the new SID procedures, the designers have complied with four key objectives specified by BAL, namely:

- Design procedures which are safe, flyable by all aircraft and in line with International Civil Aviation Organisation (ICAO) and CAA standards for flight procedure design when using RNAV-1 criteria

- Design procedures which match as closely as possible the northbound SIDs as submitted within the original ACP

- Meet the requirements of the Prestwick Lower Airspace Systemisation (PLAS), now known as Future Airspace Strategy Implementation (FASI) North, which has two specific requirements:

    - Develop one SID to take all traffic north (Whitegate not being replicable due to it being removed as part of the FASI North project)

    - Align to a new reporting point to the north of Lichfield named LUVUM (referred to as BIMBA in the consultation documentation). Due to the location of LUVUM the retention of the Whitegate SID would not be feasible.

It has already been established that the existing Whitegate procedure could not be retained due to changes to the upper airspace that are being proposed through the FASI(N) project, led by NERL. BAL, however, maintained its commitment to replicate as closely as possible the track flown by aircraft using the existing Trent procedure which close in to the Airport follows the same track as the Whitegate SID. The output of the design shows that this can be achieved.

4.2 Safety Management

Safety Management is an intrinsic element of any change to the airspace arrangements or IFPs. BAL has an obligation to provide IFPs which are safe and flyable. The Air Navigation Service Provider (ANSP) – BAATL – operates a Safety Management System (SMS) which meets the requirements specified by the CAA in CAP670 – “ATS Safety Requirements”.

In developing this ACP, sound safety management principles have been applied throughout, including in the consideration of options. The proposal has been subject to a Hazard Identification (HAZID) referred to as a HARP Form.

The initial HARP identified an issue with the LUVUM 1L SID which ended at FL080. These issues are detailed in the HARP form which can be found in Appendix E. As a result BAL asked the procedure designers to amend the LUVUM 1L SID to end at an altitude of 6,000ft common with all other SIDs. This was reassessed in a second HARP form which can be found at Appendix F and the issues were resolved.

A specific Safety Case has been developed by NATS for the proposed RNAV (GNSS) SID procedures in accordance with the CAA requirements for the introduction of RNAV procedures. This is submitted as a separate document directly to the CAA Airspace Regulation Team by NATS PDG.

Safety benefits will accrue to airspace users as a result of this ACP as it will enable the use of correctly designed RNAV SID procedures coded directly into navigation databases instead of "RNAV overlays" which consist of complex, non-compliant, conventional navigation procedures. In addition to this it will remove the requirement for aircraft to be put through the 'gate' which will reduce ATC workload.

4.3 SID Development and Simulator Flight Validation

BAL carried out a Full Simulator Assessment on 5th June 2017 of the proposed LUVUM 1L SID at Farnborough using a Q400 simulator. Whilst the SID used for the validation exercise ended at Flight Level 080 it was found that the Q400 flew the procedure without any issues in all meteorological conditions simulated. Since this assessment the SID attainment level has been reduced to an altitude of 6,000 feet. This is not anticipated to cause any issues for the Q400 aircraft. Tracks flown by the Q400 can be seen in Appendix G.

BAL carried out a further simulator assessment of the 12th June 2017 using a B737-800 simulator at the Jet2.com Training Centre in Bradford. This simulation identified that the aircraft flew the SID without issue apart from when the wind conditions were at the strongest and the aircraft was at the heaviest take-off weight. In this scenario there was an FMS disconnect between waypoints BBE22 and BBE23. BAL therefore instructed its appointed

procedure designers to make amendments to the SID in order to prevent the occurrence of FMS disconnects.

To prevent the occurrence of FMS disconnects the speed restriction at the first waypoint (BBE22) was reduced from 220 KIAS to 200 KIAS. Following this amendment BAL carried out a further Simulator Validation of its proposed SIDs on 6th March 2018, at the Jet2.com training facility in Bradford. This validation confirmed that the aircraft performed without issue on the SID, at all aircraft weights and meteorological conditions that were simulated. Tracks flown by the B737-800 during the validation can be seen in Appendix H.

5. Stakeholder Engagement

5.1 The Community

Following the submission of the original ACP BAL established a Community Stakeholder Forum where those communities most affected by the ACP were invited to attend engagement briefings at the Airport.

A total of 10 meetings were held and the group were kept informed of the design and validation process at specific meetings. Minutes of the meetings can be found in Appendix I. In addition, BAL kept the Airport Consultative Committee (ACC) informed of each stage of the process.

The Airspace Community Stakeholder Group and the ACC are both fully supportive of the re-designed SID.

5.2 Airlines

BAL has met regularly throughout the trial period with airlines operating at Birmingham Airport to inform them of the revised SID and the trial arrangements as well as seeking their views on the operational impacts of the SID.

The main consultation vehicles were the Airport's Flight Safety Committee and Operation Pathfinder Forum. The Airport's Flight Safety Committee, which, as the name implies is concerned with promoting the highest standards of flight safety at Birmingham Airport. Operation Pathfinder is a regular airline / airport forum intended to promote good track keeping performance.

In addition there has been significant consultation with Flybe, one of the principal airlines operating at Birmingham, due to the track keeping observed on the northbound SIDs.

Throughout the various meetings, no airline has reported any concerns with the fly ability of the proposed LUVUM 1L SID. The noted concern is the reduced speed restriction of 200 KIAS at BBE 22. Airlines state that this will cause a fuel burn penalty as it delays their ability to get in to a 'clean configuration'. BAL however advised of the reasoning why the speed restriction was necessary and the group recognised the overriding importance to avoid, where possible the direct overflight of communities close in to the Airport. Further to this it is Government Policy to prioritise noise over fuel burn up to an altitude of 7,000 feet.

5.3 The Civil Aviation Authority

BAL maintained regular dialogue with the CAA to keep them informed of the progress of the re-design and met with the CAA on 5 September 2017, to agree an implementation process for the new SIDs. Following this meeting, further engagement was held with the Flight Validation Team, who confirm that although the flight validation process was largely successful, a further modification to the design was required and this required simulatior validation (see section 4.3). Due to the availability of procedure designers and simulator the timescales for the final packaging of works moved from October 2017 to May 2018. The CAA case officer was kept informed at all key stages.

6. Conclusion

BAL believes it has met the expectations of the CAA, and community stakeholders, by carrying out a re-design to the originally submitted northbound SIDs from runway 15 (Option 4). This is to resolve the track keeping performance such that traffic tracks closer to the nominal SID centreline and away from the north side of Balsall Common (as originally proposed and consulted upon).

The results of the design, and the flight validation process show that BAL has been able to design a new SID that replicates the SIDs originally consulted upon in 2012.

Therefore, in conclusion BAL is putting forward the modified design for its permanent option to take aircraft north after departing from Runway 15.