

Future Airspace Strategy Implementation South (FASI-S)
Cardiff Airport

Gateway documentation:

Stage 2 Develop and Assess

Step 2A (i) Options Development



Sign-Off

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Introduction

This document forms part of the document requirements under the Civil Aviation Authority's (CAA) CAP1616 Airspace Change Process: *Stage 2 Develop & Assess Gateway, Step 2A (i) Develop Options*.

Its purpose is to provide and describe a comprehensive list of options. It is designed to be read in conjunction with document *Stage 2 - Step 2A (ii) Design Principles Evaluation*.

The CAA reference is [ACP-2019-41](#)

Cardiff Airport (CWL) formally commenced an Airspace Change Proposal in July 2019 through the submission of a Statement of Need to the CAA ([portal link](#)). This outlined Cardiff Airport's need for an airspace change including removing dependencies on the Brecon (BCN) navigation aid; coordination with the wider Future Airspace Strategy Implementation for the South (FASI-S) and alignment with the CAA's Airspace Modernisation Strategy and improving the efficiency and environmental impact of procedures.

An Assessment Meeting between the CAA and Cardiff Airport was held in September 2019 ([portal link](#)). This gave Cardiff Airport the opportunity to expand upon its Statement of Need; outline the potential issues and identified opportunities from the proposed change; and present a proposed timeline.

The Design Principles were developed with stakeholder engagement and were formalised in March 2020. Due to the Covid-19 pandemic, this Airspace Change Proposal (ACP) was then paused from March 2020 until May 2021 and has now restarted at Stage 2.

For this Stage in the CAP1616 process, Cardiff Airport have developed potential design options. Cardiff Airport have engaged with stakeholders to identify some of the factors which may impact on these designs and present them in this Stage 2A(i) document with a description of each potential option.

Option Development

Cardiff Airport is the sponsor of this proposal. Cardiff Airport seeks to achieve the following benefits from this airspace change, as per the [Statement of Need](#):

- Regulatory compliance including the Performance Based Navigation Implementing Rule (PBN IR)
- Remove reliance on ground-based navigation aids including the BCN VOR
- Introduce more efficient, precise, and environmentally friendly routes
- Support future traffic growth of Cardiff Airport and surrounding airspace
- Limit environmental and noise impacts of flights in/ out of Cardiff Airport

The SoN also outlines that this proposal must ensure coordination with the wider FASI-S programme of work and alignment with the CAA's Airspace Modernisation Strategy (CAP1711).

Cardiff Airport currently has 5 Standard Instrument Departure (SID) procedures. These are all conventional SIDs which rely on navigation aids. The current SIDs need to be replaced in order to align with the AMS and improve efficiency.

The BCN DVOR is being decommissioned in 2022 and two current SIDs (BCN 1A and BCN 1B) are dependent on the BCN DVOR. The ALVIN 1B Standard Arrival Route (STAR) also makes use of Distance Measuring Equipment (DME) ranges from the BCN DVOR to determine climb restrictions. Therefore, the baseline ('do nothing') option presented in this document is not a feasible option.

There is a conventional Hold which is located overhead the airport at the "CDF" which is a Non-Directional Beacon (NDB) located on the airfield. The Hold is currently used infrequently, in adverse weather conditions or in rare periods of very high traffic. This requires modernising to RNAV1 (required navigation) in line with CAP1711.

A delay absorption mechanism needs to be considered in the design options. This includes options such as a new hold or point merge/ trombone procedure, and in line with the Statement of Need, considers options for the suitability of a hold/procedure being shared with neighbouring Bristol Airport.

To meet all the requirements for change outlined above, and in line with the principles of CAP1616, the design options have taken a 'blank canvas' approach to explore all potential options and are not limited to replication of the current procedures to RNAV1 specification.

The options are then considered against the limitations of the current airspace around Cardiff Airport. This includes impacts on military airspace and usage, airspace classification and general aviation (GA) usage, impact on Bristol Airport procedures, and the potential environmental impacts.

This document provides an overview of the options which have been developed with stakeholder engagement. A high-level qualitative assessment describes the possible strengths and weaknesses of each option.

Stakeholder Engagement

Three design workshops were held, summarised below, targeting three specific groups affected by this change: FASI-S stakeholders, Aviation Representatives and Airlines. Each workshop had an identical agenda and presentation, with a background to the project, current airspace, and example design concepts for discussion.

This included background information on other relevant airspace change which Cardiff Airport's ACP could impact and vice versa e.g., shared benefits or overlapping design options. Cardiff Airport has included relevant change sponsors – including Bristol Airport, Exeter Airport and NATS En Route Ltd (NERL) – as key stakeholders to its design work. Cardiff Airport sits alongside these change sponsors within the regional West Terminal Airspace (WTA) deployment of upcoming UK airspace change. Cardiff Airport recognise that it is imperative we work alongside these change sponsors (alongside our other stakeholders) to ensure that airspace changes are developed through engagement and where possible, mutually beneficial.

The workshops were all facilitated by the NATS Design Lead and Airspace Change Specialist. Members from Cardiff Airport were also in attendance to answer any queries related to the airport or airspace. The slides from the workshops have been supplied with the engagement evidence.

Feedback was captured from stakeholders in a 'pros/cons' written format for each of the potential options, and this information has been used to assist in the qualitative assessment of each design presented in this document.

Relevant redacted engagement notes have been supplied to the CAA and uploaded to the portal.

All notes from these workshops have been published on the portal as engagement evidence. The tables below provide a summary of stakeholders who participated:

Workshop 1: FASI-S Stakeholder Workshop	
Date: 10 August 2021 & 1 September 2021 ¹	Location: NATS CTC
Participants: NATS ATC Design Leads (Cardiff, Bristol, LD1.1), Project Manager & Airspace Change Specialist	Cardiff Airport Bristol Airport Airspace Change Organising Group (ACOG)
Output: Notes from this meeting were sent out and agreed by attendees	

Workshop 2: Cardiff Airport Aviation Representatives Workshop	
Date: 08/13/14 September 2021	Location: St Athan Aerodrome
Participants: NATS ATC Design Lead (Cardiff) NATS Airspace Change Specialist Cardiff Airport Bristol Airport Exeter Airport Cardiff Heliport University of Wales Air Squadron	Devon and Somerset Condors UK GA (Gliding Association) ACOG North Devon Hang Gliding & Paragliding Club Osprey Consulting South West Wales Soaring Club Welsh Government, Aviation Authority & Policy Wales Air Ambulance
Output: Notes from this meeting were sent out and agreed by attendees	

Workshop 3: Cardiff Airport Airlines Stakeholders Workshop	
Date: 12 October 2021	Location: Remote (Teams)

¹ A FASI-S Stakeholder design workshop was held on 10th August 2021. Due to time restrictions on the 10th August, a short follow-up workshop was held on 1st September 2021 to complete the design options, discussion from both workshops are combined.

Participants:	Wizzair
NATS ATC Design Lead (Cardiff) & Airspace Change Specialist	TUI
Cardiff Airport	MoD Defence Airspace and Air Traffic Management (DAATM)
Aeros Flight Training	
Output: Notes from this meeting were sent out and agreed by attendees	

Stakeholders were thanked for their attendance and feedback on the initial Design Options. Cardiff Airport explained that this feedback would be analysed and reviewed against the draft Design Options and would assist with the Design Principle Evaluation of the final Design Options which would be submitted to the CAA at the end of February 2022.

A follow up engagement session with stakeholders was conducted in December 2021. Stakeholders were briefed on the updated Design Options following previous feedback, and any additional feedback was captured. This has been used to inform the qualitative assessment in this document, and in the Design Principle Evaluation document (uploaded to the [portal](#) alongside this document).

Cardiff Airport ACP Stage 2 Update	
Date: 09 & 10 December 2021	Location: Remote (Teams)
Participants: NATS ATC Design Lead (Cardiff) & Airspace Change Specialist Cardiff Airport Newport City Council Cardiff Heliport / Welsh Air Ambulance Dragonfly Air Charter MoD Babcock International	
Output: Notes from this meeting were sent out and agreed by attendees	

This section demonstrates two-way engagement with appropriate stakeholders. Engagement continues via direct email or phone contact.

Alongside the above workshops, led by Cardiff Airport, we have also attended a number of meetings in relation to the wider programme of airspace modernisation. This has allowed us to have regular contact with other change sponsors - such as Bristol Airport, Exeter Airport and NERL - and industry groups including ACOG. This engagement has been summarised in [Annex B](#) towards the end of this document.

FAI-S and Masterplan Participation

FAI-S

FAI-S is the combined programme of airspace changes to the legacy air traffic route structures in the southern part of the UK. FAI-S is comprised of several change sponsors including NATS En Route Limited (NERL), the UK's en route Air Navigation Service Provider (ANSP). NERL is responsible for airspace change to the en route network above 7,000ft such as creating additional capacity to support growth and reducing airspace inefficiencies. FAI-S also includes low-level airport changes led by change sponsors including Cardiff, Bristol, and Exeter Airports. These are focussed on low-level designs including the better management of noise impact and reduction of environmental impacts.

These change sponsors are currently leading their own ACPs which often focus on similar geographical areas of airspace. It is therefore imperative that we work together to develop airspace design options and manage engagement with stakeholders in a joined-up approach. As summarised in the above engagement evidence, Cardiff Airport has been working closely with the aforementioned change sponsors, alongside numerous other stakeholders. This has ensured that designs are progressed with other potential airspace changes in mind; allowing potential conflicts and enablers to be identified.

Masterplan

Cardiff Airport has involved ACOG throughout its Stage 2 work to ensure it is aligned with the wider UK airspace modernisation programme (FASI-S) which this ACP is part of. This is demonstrated through our two-way [engagement evidence](#). Cardiff Airport is fully supportive and aligned with ACOG's initial Masterplan which provides a high-level programme plan for airspace change in the south of England.

Cardiff Airport has also supported the recently approved Iteration 2 of the Masterplan. This specifically focuses on interdependencies between independent ACP where design conflicts or enablers could arise. As covered in our engagement evidence, Cardiff has worked alongside and engaged Bristol, Exeter and NERL throughout its Stage 2 design work. This has enabled potential conflicts to be identified early on, such as awareness of where Bristol Airport may want to introduce a Hold, and appropriate design decisions to be made. This is documented within our Design Principles Evaluation.

Cardiff Airport appreciate the support from ACOG and are confident that this Stage 2 submission is fully aligned with both iterations (Stage 1 and Stage 2) of the Masterplan. Within this document and the accompanying other Stage 2 documentation, we present a comprehensive list of viable design options which will continue to be coordinated with other regional airspace changes, notably the WTA airspace changes. We look forward to continuing to work alongside ACOG and the change sponsors of ongoing ACPs.

Design Work: Baseline (Do Nothing) Option

The following pages describe the baseline (do nothing) scenarios for Cardiff Airport

A 'Do Nothing' option representing the current day operation must be included and is used as the baseline against which all other options are measured.

Figure 1 below, shows the current procedures and traffic flows for Cardiff Airport.

Cardiff handles a wide mix of aircraft types from light training aircraft up to long haul "heavy" types serving destinations such as Doha. Most of the routes depart to/ arrive from the east and south, with the majority of direct destinations being in Western/central Europe and the Mediterranean.

Departures follow the current Standard Instrument Departures (detailed below under "current SIDs") which comply with the noise preferential routings. Normally departures will not follow the full Standard Instrument Departure route; instead after passing through altitude 3,000 feet, aircraft will be given radar headings onto more direct tracks which serve the following purposes:

- Track miles are reduced by a small margin, providing environmental benefits in terms of less fuel used and reduced CO₂ output for the flight
- Aircraft are presented to the en route ATC sector in a more efficient manner

For inbound flights, the holding fix is currently located at the "CDF" which is a Non-Directional Beacon (NDB) located on the airfield. This technology dates back to the 1930s and can suffer from various errors and inaccuracies due to its basic nature. Radar monitoring of aircraft in the hold is also impaired as it is located in the radar overhead.

Most of the arrivals to Cardiff will not route to the holding facility; instead, they are given headings to fly by ATC in order to position the aircraft for an approach to the runway. Arrivals from the east will often route directly over Bristol airport. This requires prior coordination between Bristol and Cardiff ATC as this routing impacts directly on Bristol's arrivals and departures.

Current SIDs

BCN 1A (runway 30) and BCN 1B (runway 12): northbound departures.

Runway 12 departures follow the runway direction out over the Bristol Channel for 4.5nm then turn left direct to Brecon VOR (BCN). The route crosses the coast overhead the city of Cardiff and aircraft are required by the SID to be above altitude 3500 feet prior to reaching the coast.

Runway 30 departures track away from Cardiff in line with the runway direction until 4nm and then turn right towards BCN. The right turn crosses over the area of Cowbridge, with aircraft required to be above altitude 2300 feet before beginning the turn.

Both SIDs to BCN climb to altitude 6000 feet but climb performance of aircraft and further climb issued by ATC results in much higher levels being achieved.

EXMOR 1A (runway 30) and EXMOR 1B (runway 12): southbound departures.

Runway 12 departures climb out over the Bristol Channel to altitude 5000 feet, with a right turn to the south 2nm from Cardiff Airport. Departures from runway 30 track the runway centreline until 4nm, avoiding St. Athan Aerodrome, then turn left to almost parallel the initial departure track, climbing over the sea until south of Cardiff Airport, before turning right towards the South.

Climb performance and further climb instructions from ATC enable levels in excess of altitude 7000 feet to be achieved before aircraft reach the Somerset coast.

ALVIN 1B (runway 12): eastbound departures.

ALVIN is only incorporated into one SID, departing from runway 12. This climbs over the Bristol Channel to 4.5nm, then turns north towards the coast until Cardiff docks, whereupon the route turns north east to follow the coastline. Aircraft are required to be above altitude 3500 feet prior to reaching the coast (based on a distance from BCN VOR) and above 4500 feet in the region of Cardiff docks.

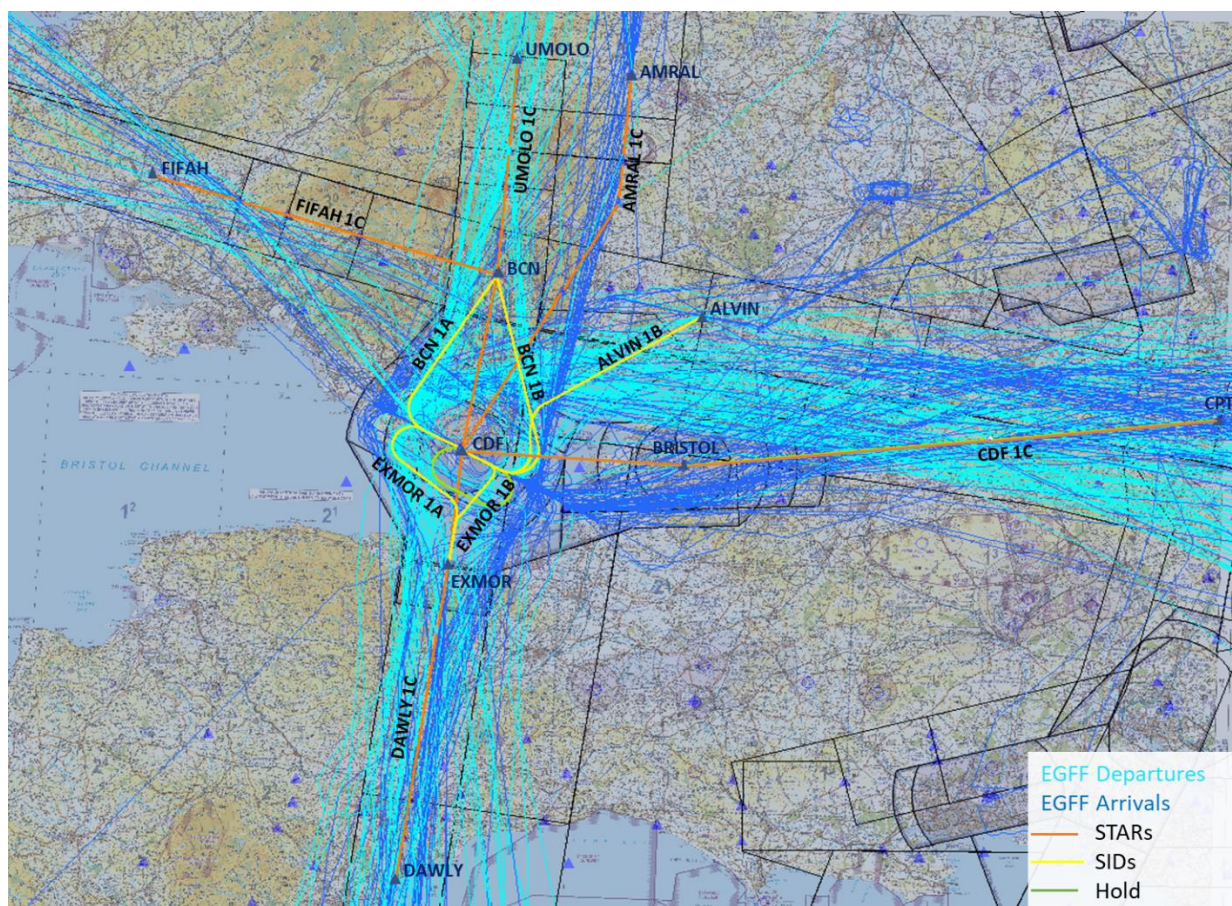


Figure 1 Current Procedures and Traffic flows for Cardiff Airport (2019 traffic)

Current airspace

Figure 2 below shows the current airspace classifications around Cardiff Airport. The airport is surrounded by a Class D Control Zone (CTR) which is orientated with the runway direction, approximately 13nm long and 10nm wide. The CTR starts at ground level and rises to approximately 10500 feet (FL105) and encompasses both Cardiff and St. Athan airports.

Surrounding the CTR is the Cardiff Control Area (CTA), also Class D airspace, with various base levels above the ground from 1,000ft south east of Cardiff, to FL75 (approximately 7500 feet) to the north east. The current Standard Instrument Departure routes (SIDs) are contained within this controlled airspace structure.

Class D airspace permits both Visual Flight Rules (VFR) and Instrument Flight Rules (IFR) flights, both in / out of Cardiff as well as flights transiting the airspace. Cardiff is located adjacent to a short stretch of water over the Bristol Channel. VFR transit aircraft are more likely to make use of Cardiff Airspace when crossing this area, rather than route across longer stretches of water to the west. Airspace design must therefore consider continued operations by VFR aircraft routing through this area, as well as traffic into or out of Cardiff.

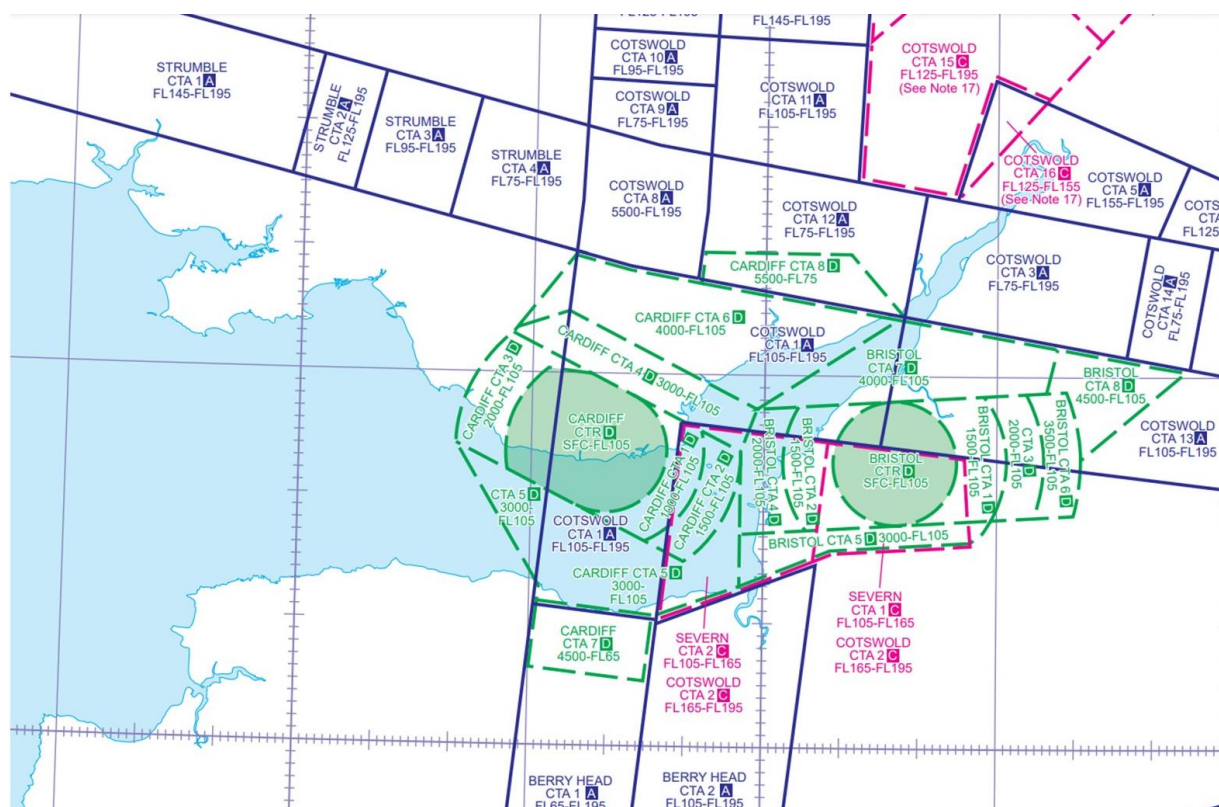


Figure 2 Current Airspace Classifications: CARDIFF

Due to its proximity to the east of Cardiff, departures and arrivals from Bristol Airport interact closely with Cardiff air traffic movements, requiring robust procedures and coordination between the two airports Air Traffic Control units. Cardiff airport also requires close coordination with operations at St. Athan Airport, which shares the CTR 3nm to the west of Cardiff Airport. The close grouping of these airports and the way in which the airspace surrounding Cardiff is shared, requires that any airspace design options carefully consider how these airports interact.

Although most arriving and departing IFR traffic at Cardiff is contained within the boundaries of current controlled airspace, tactical use is made of direct routings to the north west by both Cardiff and Bristol. This involves a small portion of flights outside the protection of controlled airspace between the Cardiff CTA and the airways system north of Swansea. Consideration must be given to how this portion of airspace is used and options for protecting flights, whilst also being cognisant of the requirements of other airspace users in this area of uncontrolled airspace.

Option Development – Arrivals and Departures

Departure and arrival procedures at Cardiff Airport need to consider a variety of factors. This includes traffic flows and demands; the interactions with Bristol traffic; current and potential airspace classifications; interaction with en route network (redesign), local geography/topography, and the impact on other airspace users. The following section provides a brief overview of these factors in order to provide context for the design options.

Consideration needs to be given to a delay absorption mechanism in the design options. This includes options such as a new hold or point merge/ trombone procedure, and in line with the Statement of Need, considers options for the suitability of a hold/procedure being shared with neighbouring Bristol Airport. This is covered later on in this [document](#).

Cardiff Airport Future Operation

Cardiff Airport, prior to the onset of the COVID 19 pandemic, had a passenger operation of circa 1.63 million passengers per annum (2019), this was an increase of 4% versus 2018 passenger numbers.

During the same time period Air Transport Movements (ATMs) increased by 2.3% to approximately 32,000 movements. This has been a growth from 25,000 ATMs since the last recession ended in 2013.

Cardiff Airports future projections for traffic growth include both an increase in passenger numbers and ATMs. There is a degree of uncertainty in any projections as a result of recovery from the COVID-19 pandemic but, traffic is expected to reach approximately 40,000 ATMs within the next 5 years.

The predominant flow of traffic is to the east and south of the airport, with the key destinations being short haul European routes. Recently an increase in long haul flights has occurred, with a daily route to Doha, and domestic travel accounting for approximately 13% of total passenger numbers. The remaining 87% of passengers using the airport are international travellers with 40% of all international passengers travelling to Spanish destinations.

Interaction with Bristol

The proximity of Bristol Airport impacts potential designs for both the Cardiff Airport ACP and the concurrent Bristol Airport ACP. Bristol Airport has higher traffic levels than Cardiff Airport, and as this is most likely to continue; design options need to consider this. Significant engagement between Bristol and Cardiff is assisting with optimised design development.

Figure 3 shows radar data with both Cardiff and Bristol traffic depicted (summer 2019). Direct concentrated tracks are shown out of Cardiff, with Brecon (BCN) VOR clearly not being used by a lot of the routes.

This is due to aircraft being issued with radar headings in order to present them to the next ATC agency in a way that makes more effective and efficient use of the airspace. Bristol departures to the south-west impact where Cardiff can position a new Hold (over the channel).

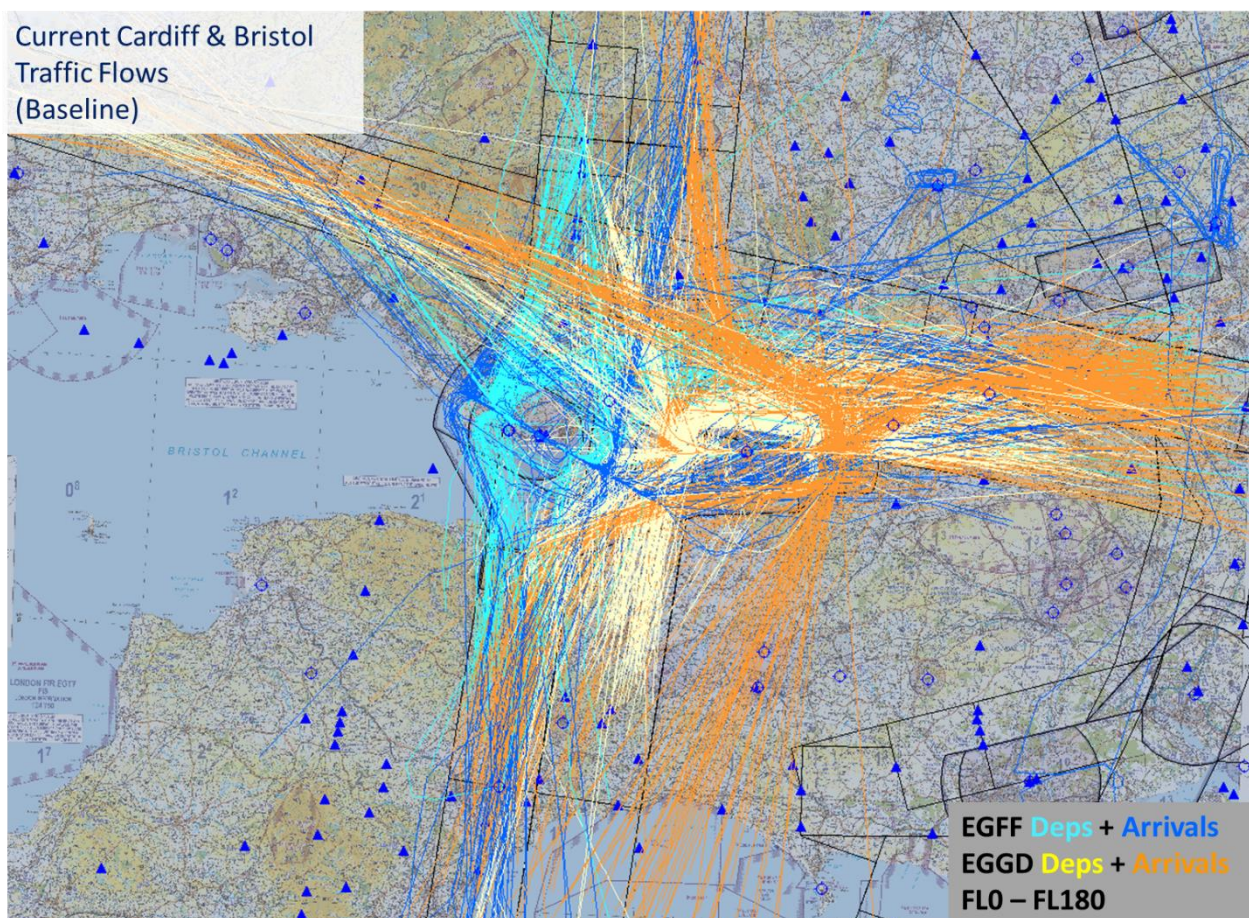


Figure 3 Current (baseline) Traffic flows for Cardiff & Bristol Airports (2019 traffic)

Controlled Airspace (CAS)

At this stage in the design process, it is too early to determine whether changes to controlled airspace may be required. However, the following considerations have been captured during engagement with stakeholders during design development workshops.

These areas include the Cotswold CTA (4A/ 9A/ 11A/ 8A/ 12A/ 3A) to the North of Cardiff, uncontrolled airspace to the north-west of Cardiff and the Severn CTA to the south-west of Bristol Airport. Cotswold CTA to the north may require its base raising, however it is too early in the process to assume any changes.

Feedback from engagement with stakeholders indicates that lower-level CAS restrictions could greatly impact GA. This would be compounded by the natural limitations of local terrain (mountainous) and weather conditions (low lying cloud) which already limit General Aviation (GA) activity to head east and closer to Cardiff airport.

Link with Network/FASI-South proposals

NATS (NERL) are proposing changes to the network in line with the Airspace Modernisation Strategy, to systemise the airspace from 7000 feet above Cardiff. As described in the Statement of Need, the FASI-South programme of airspace changes is designed to co-ordinate these network changes along with those required by 16 airports in the south region in order to modernise the airspace.

The proposed changes for Cardiff departures and arrivals will need to link in with the proposed network, which will change from that currently published and utilised.

The proposed LD1.1 route structure has systemised routes for inbound / outbound traffic with allocations for Cardiff and Bristol traffic to specified routes. In completing this initial design work, consideration is given to this route structure, to assist in developing the optimal solution, which meets the needs of Cardiff Airport but also maximises the benefits of the large-scale programme, as well as considers the impacts of training and safety concerns.

Airspace Users

The following are significant users of the airspace around Cardiff, whose needs and requirements will be considered during the development of designs.

Training flights: The airspace to the north-west of the airport is not capped, for training purposes. Training flights regularly operate up to around 9000 feet. This is a very valuable piece of airspace for flight training, specifically over the edge of the water.

MoD Operations: The MoD operate out of St Athan and has regular military training flights. The MoD currently operate Monday–Friday 0900–1700.

MoD spinning aerobatics operate north-west of Cardiff Airport. These operations require ground -> FL100 (10,000ft). The spinning/ aerobatic exercises should all take place above 3,000ft, and can be as high as 9,000ft. These are primarily conducted over the land and are not permitted over the water at all in the winter.

Spinning exercises are affected by the terrain closer to Swansea therefore much of this occurs closer to Cardiff Airport, alongside Swansea Airport not always being able to offer MoD a traffic service. The MoD encourage student flyers to talk to ATC frequently, for practice and training purposes.

Cardiff Heliport (Air Ambulance): Cardiff Heliport operations are typically at low altitudes, around 1,000ft–1,500ft, weather dependent.

Heliport operations sometimes use the Cardiff Instrument Landing Strip (ILS) procedures during bad weather situations, which puts them at higher levels. Cardiff Airport assist these operations as a priority if needed (Cat A flights) i.e., vector them. A key requirement for the heliport is to maintain the current procedures for these operations. The helicopters carry less fuel than most aircraft into Cardiff which restricts them from being able to hold for a long duration.

Engagement with Cardiff heliport so far has indicated that the proposed Hold and transition options pose no major concerns for heliport operations however, if the airspace bases were drastically lowered, then this could create an issue.

An extension of the Cardiff Terminal Control Area (TMA) down to as low as 2,000ft would negatively impact helicopter operations, and could compromise the Welsh Air Ambulance operations.

Cardiff Heliport is currently looking at the possibility of introducing an Aerodrome Traffic Zone (ATZ) around it, due to an increased amount of transit traffic. This is designed to provide increased protection. There is quite a lot of traffic routeing above in the overhead which an ATZ would mitigate against. Engagement has highlighted there may be a particular issue when pilots don't turn on heliport view which means they are not able to identify the Heliport at all.

Paragliding Operations: Paragliders generally fly up to around 4,000ft – 4,500ft but it is wholly dependent on the cloud base which can drop down very low (they don't fly any higher than the cloud

base). Paragliders do not operate over the sea. The main concern for paragliders is if Cardiff traffic drops below current airspace bases.

Changes to the north-west of Cardiff Airport could be problematic for the paragliding community, as they regularly fly from the hills to the coast. Cross-country flights are increasing in distance (up to 300km) due to increased skills. An increase to CAS could create a huge impact on these flights. They are light flights which don't carry the typical sort of navigational or radio equipment used in larger aircraft.

GA Operations: The impact on GA operations is expected to be much greater than on heliport operations based at Cardiff Heliport. Any increase to controlled airspace below 4,000ft could create a large impact on the GA community.

Cardiff Airport have stated that they are not specifically looking to gain more CAS, the priority is to optimise the use of current CAS (albeit changes may be needed). Consideration could be given to flexible timings or restrictions to maximise airspace use for GA.

Local populations

The design of current routes takes advantage of climbing over the sea, which minimises the impact on conurbations.

The above provides some background context and will impact the design options suitable for Cardiff Airport. The following sections outline the potential design options, and provide a qualitative assessment of their feasibility, based on engagement with stakeholders and the constraints described above.

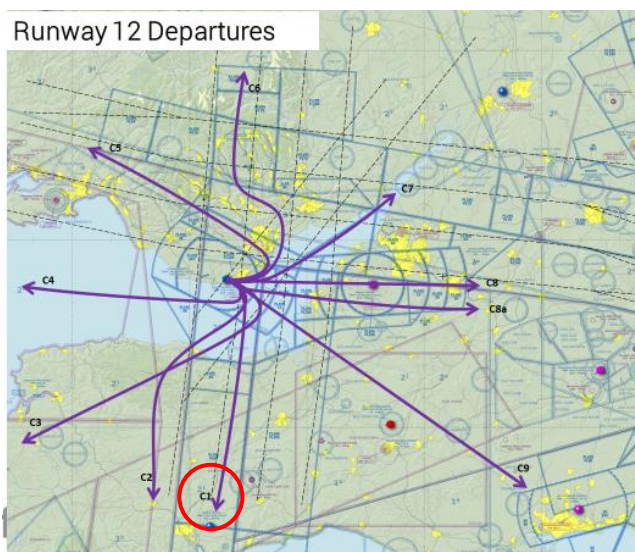
Design Work: Runway 12 Departure Options

A brief description of each option and the potential benefits and issues identified through stakeholder workshops are summarised below; where it is identified that these could relate to a Design Principle this is indicated as (DP). A full list of Design Principles is in Annex A.

SID profiles should take low performance aircraft into consideration e.g., minimum climb gradients. The following options are very unlikely to impact upon heliport operations which will be much lower

SID C1 – RWY 12 departures to the South: departures get airborne then immediately turn right. This route is similar to the current SID via EXMOR (EXMOR 1B) and is contained within current established controlled airspace.

Runway 12 Departures



All initial phase of climb is over the water with climb altitudes above 7,000ft achievable by the north coast of Somerset.

Continuous climb above 7,000ft may be affected by the choice of transition from the inbound network routes and the siting of any hold to the south.

Route provides minimal noise issues for populations on the ground and has raised no concerns from GA or Military airspace users. The route aligns with the network according to the current proposals within the LD1.1 West Airspace Deployment.

C1 Potential Benefits

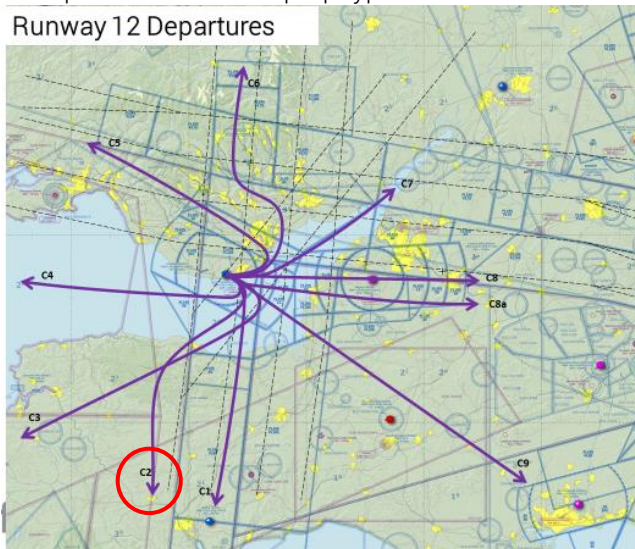
Similar to what is flown today (current EXMOR SID) (DP1)
 Climb over water offers noise benefit. (DP5)
 Could be used for low performance aircraft (DP1)
 Minimal impact on MoD (DP6)
 Minimal impact on GA operations (potential that gliders are around 3,000ft by the coast but not typical) (DP7)
 The route is contained within current established controlled airspace. (DP8)
 A known large amount of traffic flies to/ from the south (DP2)
 Delivers traffic to LD1.1 proposed network southbound route (DP1)

C1 Potential Issues

Possible impact on Exeter departures (dependent on NERL network route choice) (DP11)
 Continuous climb may be affected by holds to the south and associated transitions. (DP3 & DP4)

SID C2 – RWY 12 departures to the south: The route follows a longer track over water than the current southerly departures from Cardiff, enabling higher altitudes to be achieved by landfall, a benefit for lower performance turboprop types.

Runway 12 Departures



Due to the over water track, there is minimal impact on GA or military flights at lower levels as the route is contained within current controlled airspace until reaching the north west coast of Somerset. The south-westerly turn after departure adds a small amount of extra track mileage than option C1, and the route connects with the Network in the opposite direction to current proposals. Continuous climb may be affected by holds to the south and associated transitions. The route will also require controlled airspace being increased to the west of the current Berry Head CTA although the majority of this will be above 7,000 feet.

C2 Potential Benefits

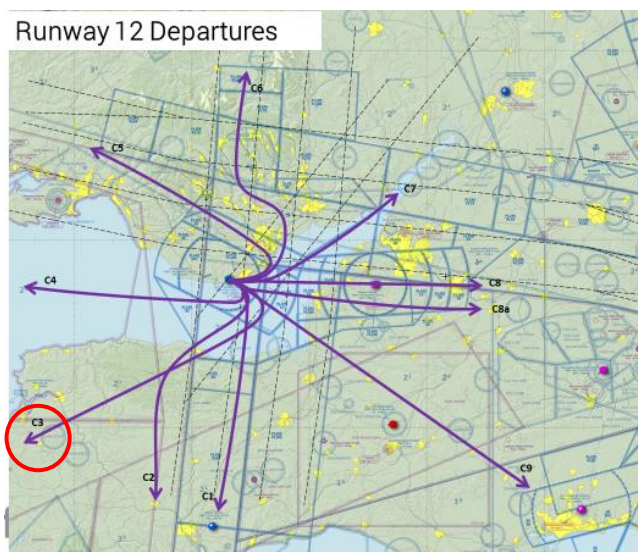
Similar to what is flown today/current EXMOR departure (DP1)
 Longer track over water offers noise benefits/possible fuel benefits to some aircraft (DP4 & DP5).
 Minimal impact on GA or military flights at lower levels as uses existing airspace. (DP6 & DP7)
 Departures should be high enough to avoid impact on Exeter operations (DP11)

C2 Potential Issues

Additional track mileage (DP4)
 Continuous climb may be affected by holds to the south and associated transitions. (DP3 & DP4)
 Increase in controlled airspace (mostly above 7000 feet) (DP8)
 Does not align with proposed network route structure (DP1)

SID C3 – RWY 12 south-west departures. Planned primarily as an early morning route for traffic joining more southerly Atlantic tracks, or routing to destinations such as Portugal, Spain, or the Canaries.

Runway 12 Departures

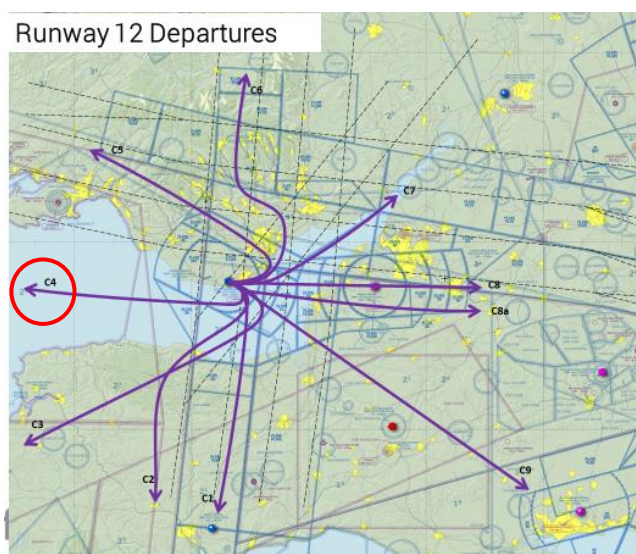


As with route C2, a reasonable track distance over water permits climb to above 7,000ft before making landfall.

Departures on this track may be held down by holds and transitions south of Cardiff, but this will have no impact on GA, or military.

C3 Potential Benefits	
Departure could achieve quite a rapid climb over the water (noise benefit) (DP5) Expectation that the current fleet mix could achieve this profile (DP1) Potential small saving in airline route charges (from the current "T" routes which are used) (DP3) Minimal impact on MoD or GA users (only early morning use) (DP6 & DP7) Departures should be high enough to avoid impact on Exeter operations (DP11)	
C3 Potential Issues	
Difficult to link in with network (DP1) Low demand anticipated for this route/ direction (DP2, DP3).	

SID C4 – RWY 12 This westerly departure is intended to provide for departures routing to Irish destinations and Atlantic crossing, avoiding danger areas on the South West tip of Wales.



This route climbs out over the sea without crossing any land areas, providing no noise issues for the local population.

There is no direct link with the network proposed in LD1.1 ACP.

Traffic on this route may be held down by a holding facility or transitions, but due to the track over the sea it will have no impact on GA. Airline customers believe this would have infrequent use.

C4 Potential Benefits	
Low impact for MoD (DP6) Minimal impact on the GA community (DP7) Noise benefits from climb entirely over sea (DP5) Supports growth for more western/ transatlantic destinations (DP3)	
C4 Potential Issues	
Infrequent use therefore lack interest from airlines (DP2) Significant amount of additional controlled airspace required (DP8) No direct link with the proposed network (DP1) Traffic on this route may be held down by a holding facility or transitions (DP3 & DP4)	

SID C5 – North-westerly departures. This route has benefits over the current standard departure which

Runway 12 Departures



routes via BCN before turning west, providing environmental benefits by allowing for more direct tracks to the north west.

The majority of the climb is inside current controlled airspace, but a small section of controlled airspace would be required to the north west of Cardiff. Addition of controlled airspace to protect this route may have an impact on military and GA operations due to the area between Swansea and the western edge of the Cardiff CTA being used for spin training.

Use has already been made of this direction in order to shorten track mileage for departure routing North-West.

C5 Potential Benefits

Should be simple to integrate with network (DP1)

Formalises current tactical vectoring and current operation (DP1)

C5 Potential Issues

Most impact of all the potential SIDs from RWY 12 on the MoD. This is due to the airspace to the south of the track required for SID protection. If this was routed to the north of the city, this would have a much lesser impact on the MoD. (DP6)

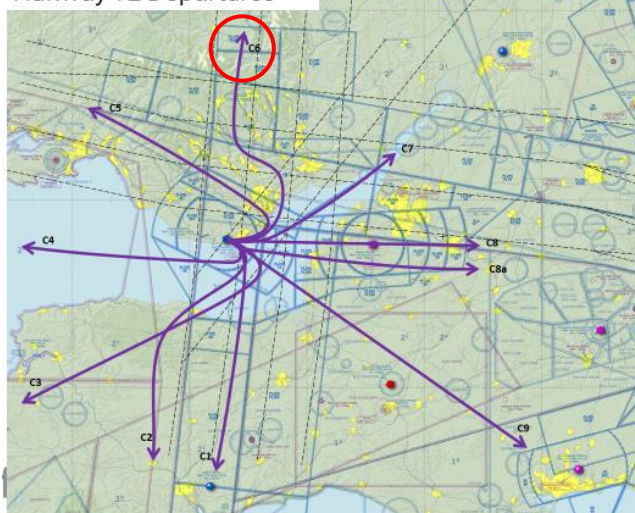
Addition of new CAS may impact on GA flights with reduced area they can operate in (DP7)

Potential noise impact for Cardiff City Centre (DP5)

Known wind-farm development in this region (DP0)

SID C6 – Runway 12 departure to the north

Runway 12 Departures



Following a similar track to the current BCN departure from RWY 12 (BCN 1B), this route aims to make use of PBN in order to minimise flight over local population densities and join the network on the proposed northbound tracks from Bristol and Cardiff.

As well as this environmental benefit, use is made of existing controlled airspace, so has no adverse impact on GA or military activity.

C6 Potential Benefits

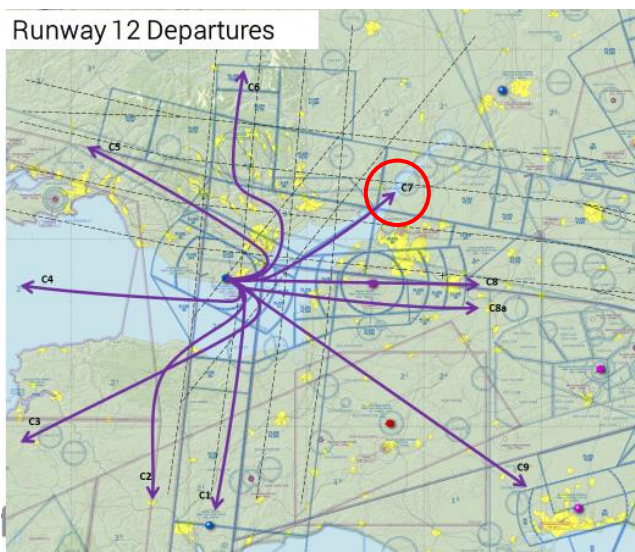
Minimal impact on GA/ MoD (DP6 & DP7)
 Contained within current CAS (DP8)
 Should be simple to integrate with network (DP1)
 Similar to current BCN departure (slightly further to the east) – follows current tracks in use (DP1)
 Routed to make use of the channel and to avoid populated areas (DP5)

C6 Potential Issues

GA have raised that it would impact upon their operations if the 4,000ft base was lowered (DP7)
 Extended track mileage due to specific positioning around populations (DP3 & DP4)

SID C7 – RWY 12 departure to the north-east up the channel.

Runway 12 Departures



This departure is contained over the Bristol Channel and makes use of existing airspace, providing an environmental benefit to the local population, and not impacting on GA, or military activities.

Collaboration with Bristol will be required due to the impact on planned arrival routes from the north and east for Bristol RWY 09.

C7 Potential Benefits

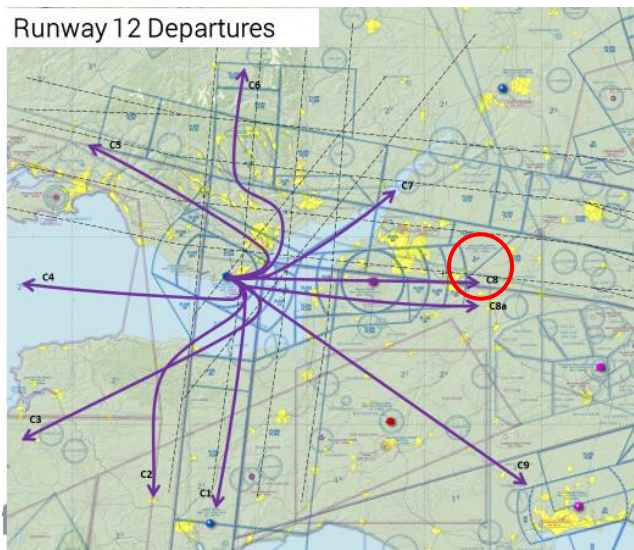
Potential increase in traffic to the east in the future (DP2)
 Useful for low performance aircraft (DP1)
 No impact on MoD (DP6)
 Minimal impact on GA, particularly by the time aircraft reach land (DP7)
 Should be simple to integrate with network (DP1)
 Similar to what is flown today (DP1)
 Noise impact benefit from being situated over water (DP5)
 Less track miles flown than today (DP3 & DP4)
 No additional controlled airspace required (DP8)

C7 Potential Issues

Probably required to join the network further south – minimum height restrictions may be required
 Possible interaction with Bristol 09 arrivals from the north and Runway 27 departures to the north/ east (DP11)
 Quite workload intensive e.g., coordination with both Swanwick and Bristol (DP0)

SID C8 – RWY 12 departure to the east (two slightly different options). This route provides a more

Runway 12 Departures



direct option for Cardiff departures routing to the east. Climb is contained within controlled airspace and as such has no adverse effect on GA, or military activity. Environmental benefit is gained by easterly departures having a more direct routing and the majority of initial climb being over the Bristol Channel.

As the track is directly over Bristol, there will be an impact on Bristol departures, with the potential to inhibit any continuous climb. The track also meets the network where LTMA inbounds are planned to be routed, leading to the possibility of Cardiff traffic being held down, followed by the subsequent knock-on effect for Bristol departures to the east.

There is an LoA in place for paragliders in the region around Bath racecourse, allowing them access to an additional 500ft. It is rarely used so should be minimal impact. Relates to Routes C8 and C8a.

C8 Potential Benefits

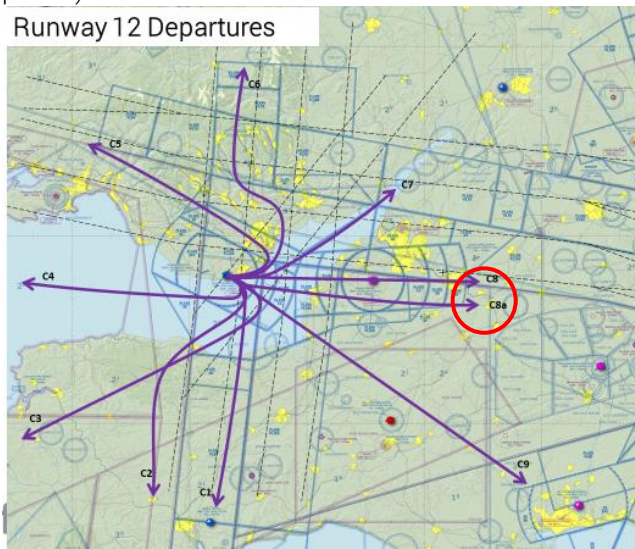
- Would be used frequently (DP2)
- Fuel saving for airlines, more direct than the current dogleg (DP3 & DP4)
- Negligible impact on GA (DP7)
- Within existing CAS (DP8)
- This would likely work with eastbound network routes (DP1)

C8 Potential Issues

- Not appropriate for low performance aircraft (DP1)
- Operational complexity from potential radar clutter above and around Bristol Airport (DP0)
- Complexity of ATC procedures alongside Bristol departures (DP0 & DP11)
- Complexity with LTMA inbounds, could prevent continuous climb (DP0, DP2, DP3 & DP4)
- Likely interaction with Bristol arrivals (DP11)
- Incredibly busy area of airspace in the morning (DP1)
- MoD impact – safety concern with Salisbury Plain Danger Area (DP6)
- Significant delay potential due to impact with Bristol traffic (DP2 & DP11)
- Increased workload due to co-ordination with Bristol (DP0)

SID C8a – RWY 12 alternative departure to the east (possibly used during first rotation, known busy period).

Runway 12 Departures



This track follows a similar route to Option C8, having the same environmental benefits but remains south of the LTMA inbound network track.

Again, there is no impact on GA or military users, but Bristol departures from RWY 27 turning east will be affected. The track also routes through the Salisbury Plain danger areas north of Boscombe Down.

There is an LoA in place for paragliders in the region around Bath racecourse, allowing them access to an additional 500ft. It is rarely used so should be minimal impact. Relates to Routes C8 and C8a.

Potential Benefits

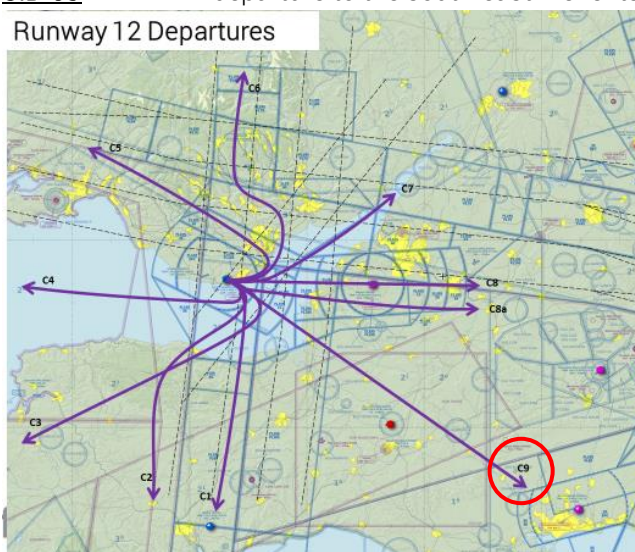
- Good alignment with network route structure (DP1)
- Would be used frequently (DP2)
- Fuel saving for airlines, more direct than the current dogleg (DP3 & DP4)
- Negligible impact on GA (DP7)
- Within existing CAS (DP8)

Potential Issues

- Not appropriate for low performance aircraft (DP1)
- Operational complexity from potential radar clutter above and around Bristol Airport (DP0)
- MoD impact – safety concern with Salisbury Plain Danger Area (DP6)
- Significant delay potential due to impact with Bristol traffic (DP2 & DP11)
- Increased workload due to co-ordination with Bristol (DP0)

SID C9 – RWY 12 departure to the south-east. Benefits from more direct track for Cardiff departures

Runway 12 Departures



routing to the south east. Environmental benefit is also gained by most climb being over the Bristol Channel, within controlled airspace. The route transits through areas used by Boscombe Down, so there may be impact on military activity if the route is used at any time other than early morning.

Controlled airspace will be left where the route passes north of Bridgwater, but with the levels that are anticipated to be reached, there will be minimal impact from GA activity. Any holding facility to the south and associated transitions to Bristol will have an impact, affecting potential for continuous climb. Consideration will also have to be given

to how this track enters the network in the region of Bournemouth/Southampton, due to the angle at which it cuts across current established routes.

Potential Benefits

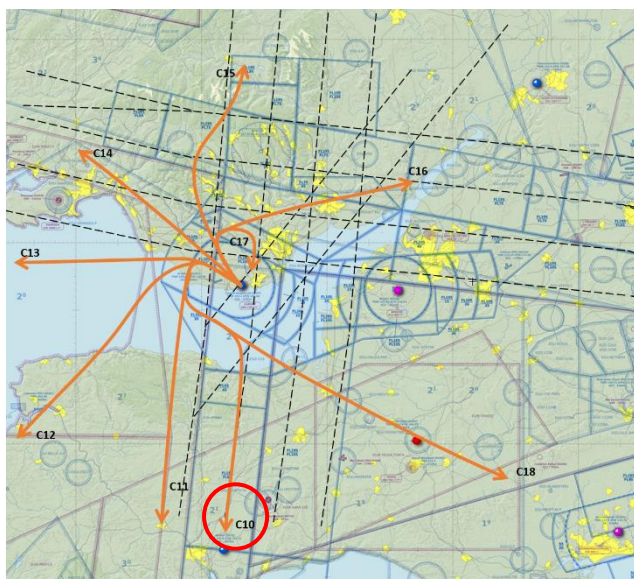
Useful for low performance aircraft (DP1)
 Fuel saving for airlines – more direct route (DP3 & DP4)
 Minimal impact on GA (DP7)
 Benefit of flying over the channel early on (DP5)
 Could be used as an early morning/ first rotation offload route (before MoD usage) (DP2)

Potential Issues

Large military impact / known military interactions (TRA) unless restricted to AM (DP6)
 Potential difficulty with integrating into the network (DP1)
 Large new controlled airspace required (DP8)
 Potential conflict with Bristol arrivals (DP11)
 Increased workload for Hurn sector controller (DP0)
 Height of aircraft may cause interactions with London traffic e.g., Heathrow arrivals (DP11)

Design Work: Runway 30 Departure Options

SID C10 - RWY 30 departures to the south. Track follows the same route as current RWY 30 EXMOR departure (EXMOR 1A).



A straight ahead track in the initial stage of the climb is required to avoid overflying St. Athan airfield and obstacles west of Cardiff Airport.

The ground below the initial climb out is sparsely populated and the majority of the departure is contained over the sea. Depending on selected holds and associated transitions, the departures may be held down for a short period, but this will be contained over the sea.

The route aligns with the network according to the current proposals within the LD1.1 West Airspace Deployment.

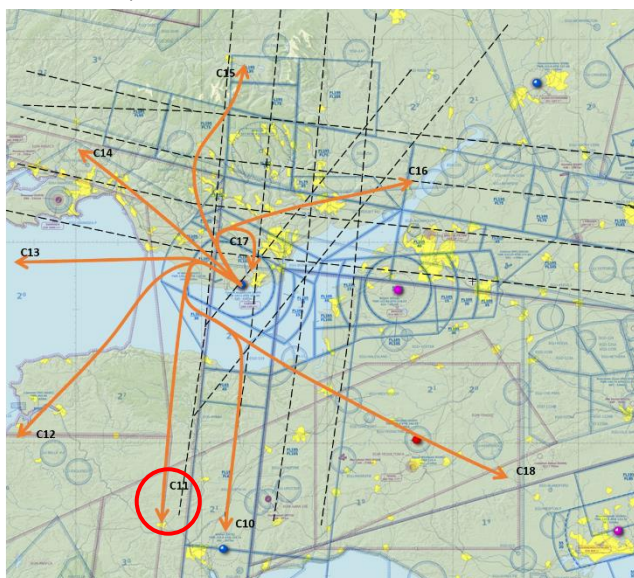
C10 Potential Benefits

Similar to what is flown today (current EXMOR departures) (DP1)
Good network alignment (DP1)
Negligible impact on GA and MoD (DP6 & DP7)
Noise benefit from lots of the initial climb being over water (DP5)

C10 Potential Issues

Routes around St Athan (albeit no change from today) (DP4, DP11)
Continuous climbs may be affected by transitions and any hold to the south (DP3, DP4)

SID C11 - RWY 30 departures to the south. As with C10, follows the initial track of the current EXMOR RWY 30 departure.



The route then tracks south directly across the Bristol Channel, so climb distance over the sea is less than route C10.

Any hold situated over the north coast of Somerset has the potential to restrict climb altitude for departures using this option, although the impact of any transitions will be less, providing more scope for continuous climb to a level beneath holds in this area.

The route connects with the Network in the opposite direction to current proposals.

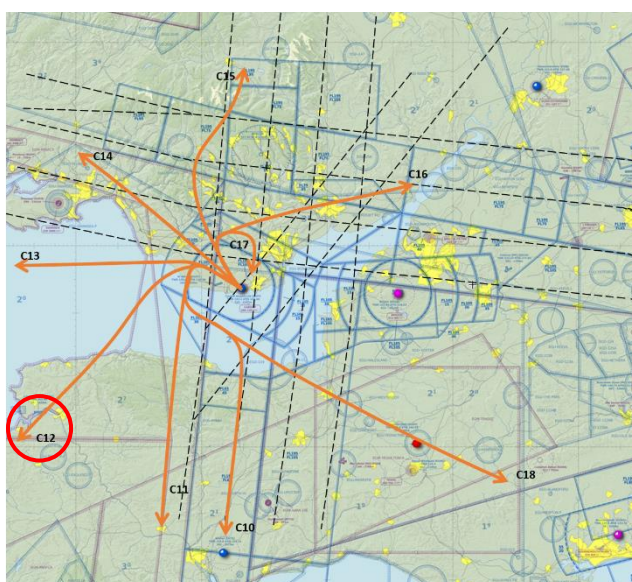
C11 Potential Benefits

Similar to what is flown today (current EXMOR departures) (DP1)
Negligible impact on GA/gliding and MoD (DP6, DP7)
Departures should be high enough to avoid impact on Exeter operations (DP11)
Noise benefit from lots of the climb being over water (DP5)

C11 Potential Issues

Extra controlled airspace most likely required (DP8)
May need to be held down due to potential Hold location (DP3, DP4)
In close proximity to St Athan (DP11)
Opposite alignment with network routes (DP1)

SID C12 - RWY 30 departures to the south west. This route is planned as an early morning option for departures routing towards Land's End for destinations such as Spain, Portugal, and the Canary Islands, as well as more southerly Atlantic tracks.



Environmental impact is negligible as the initial stage of the route is similar to current departures from Cardiff, then climb is contained over the sea prior to crossing the North Devon coast.

There is likely to be little impact from any chosen holds, or transitions, enabling continuous climb. Both track and potential for continuous climb has the added benefit of not affecting any GA, or military activity.

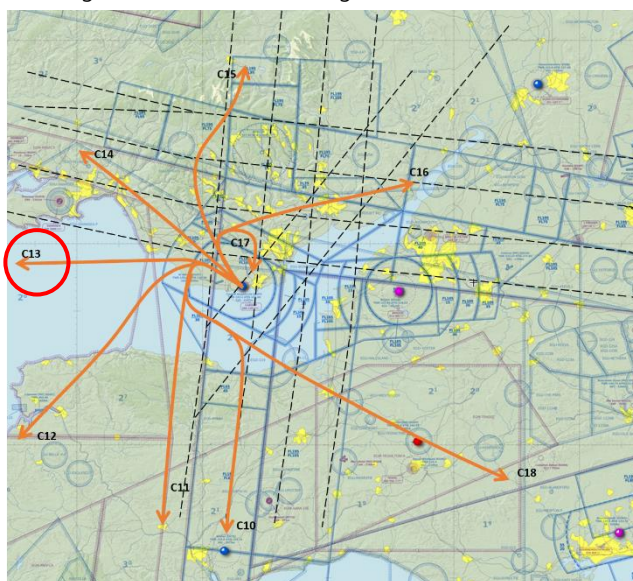
C12 Potential Benefits

Allows MoD to continue with their operations as today (DP6)
Minimal impact on MoD or GA users (only early morning use) (DP6 & DP7)
Noise benefit from lots of the climb being over water (DP5)
Expectation that the current fleet mix could achieve this profile (DP1)
Potential small saving in airline route charges (from the current "T" routes which are used) (DP3)
Departures should be high enough to avoid impact on Exeter operations (DP11)

C12 Potential Issues

Difficult to link in with network (DP1)
Low demand anticipated for this route/ direction (DP2, DP3)

SID C13 – RWY 30 departure to the west. This climbs over sparsely populated ground areas before tracking over the sea, allowing for minimal noise nuisance to local areas of population.



Destinations in the south of Ireland, or links to southerly Atlantic tracks are intended to be served by this route which, due to its position, will not affect GA, or military activity.

As with option C4, the danger areas south of Pembroke and in Carmarthen Bay can be avoided.

The impact of any hold, or transition locations is minimal, but there is no direct connectivity with the network along this track.

C13 Potential Benefits

Noise benefit from being primarily all over water (DP5)

Support growth for more western/ transatlantic destinations (DP2)

C13 Potential Issues

Large impact on MoD operations in this area (DP6)

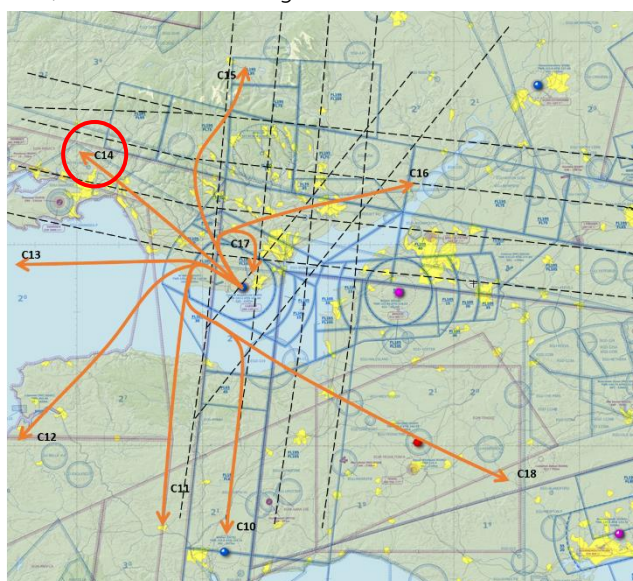
Potentially require significant amount of CAS for protection purposes

Impact on GA stakeholders if CAS required (training flights/spinning) (DP7)

Very low demand anticipated for this route (DP2, DP3)

Does not align with network – further work required (DP1)

SID C14 – RWY 30 departure to the north-west. A more direct track than the current departure via BCN, therefore benefiting from reduced track distance.

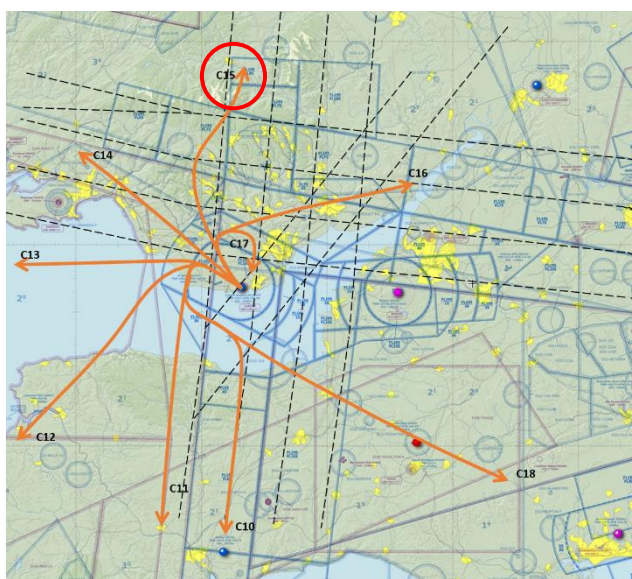


Initial climb however is contained over the land with an impact on the local population (closely overflying Cowbridge).

This route will also require additional controlled airspace having a direct impact on both military and GA activity where spin training is carried out along coastal areas west of St. Athan airfield.

Potential Benefits
Within an established route structure and current operation (flight planned via BCN) (DP1) Support future growth for west-bound traffic (DP2)
Potential Issues
Additional CAS required (DP8) Huge impact on the MoD, this could effectively shut MoD operations down. (however, if this were routed further to the north, this could reduce/ even remove MoD impact) (DP6) May overfly the Cowbridge area – newly overflown (DP5) Potential impact on gliding operations (lots of gliding sites around Brecon) (DP7) Could conflict with network traffic (DP1) Known wind-farm development in this region (DP0) Large impact on GA users (DP7)

SID C15 – RWY 30 departure to the north. Rather than following the current departure track towards BCN, this route is designed with network connectivity in mind.



The route as currently envisaged may affect the settlement of Cowbridge 5 nm north west of Cardiff Airport.

The location of St. Hilary mast (4nm north west of Cardiff Airport) has an impact on the track and climb profile required by this route.

Both of these factors will need to be considered in defining the exact track and required climb profile.

A small segment of controlled airspace would also be required to the south west of BCN VOR to accommodate the route joining with the network.

Potential Benefits
Contained within existing CAS, may require minimal lowering (DP8) No impact on MoD operations (DP6) No impact on Bristol Airport (DP11) Able to avoid flying above populated Bridge end (DP5) Should be able to align with the en route network (DP1)
Potential Issues
Potential impact on gliders around 5,000ft (DP7) Area of known windfarm development (DP0) Potential interaction with slow Cardiff departures (DP2) Potentially increased workload for Sector 5 controllers (DP1)

SID C16 – RWY 30 departure. Contained entirely within controlled airspace, this route takes a more direct route to the north east than the current SID which uses BCN (environmental benefit).



The track mileage saved with this option is significant, due to the large demand for easterly departures from Cardiff and is intended to join the network on the planned easterly departure tracks for Cardiff and Bristol airports.

Depending on the final choice of exact track on the ground, there may be an impact on local population centres (as with route C15) in the initial stage of climb only. Following a turn to the north-east, the track can be designed to avoid Cardiff City and have minimal impact on Newport.

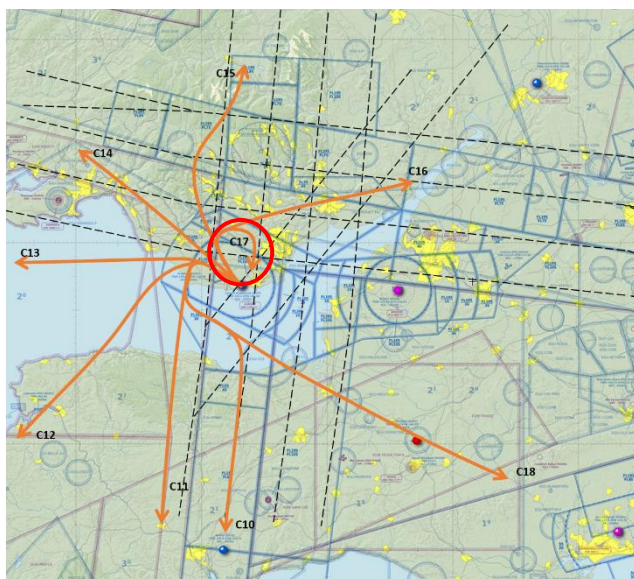
Potential Benefits

High above GA operations in this region (above 8,000ft) so no impact (DP7)
 Utilises existing airspace (DP8)
 Very similar to what is flown today (DP1)
 Could be positioned above other Cardiff traffic (DP2)
 Likely to make the height required for network integration (DP1)
 Procedures for safely crossing Cardiff/ Bristol traffic are known and used today (DP1)

Potential Issues

Potential interaction with Bristol north-west departures (height restrictions could be used as there has to be a cross-over at some point) (DP11)
 LTMA inbounds could prevent continuous climbs (DP3, DP4)

SID C17 – RWY 30 wrap-around departure to the south. A “wrap-around” departure to the south, this route will enable continuous climb to be achieved and jump holds to the south of Cardiff.

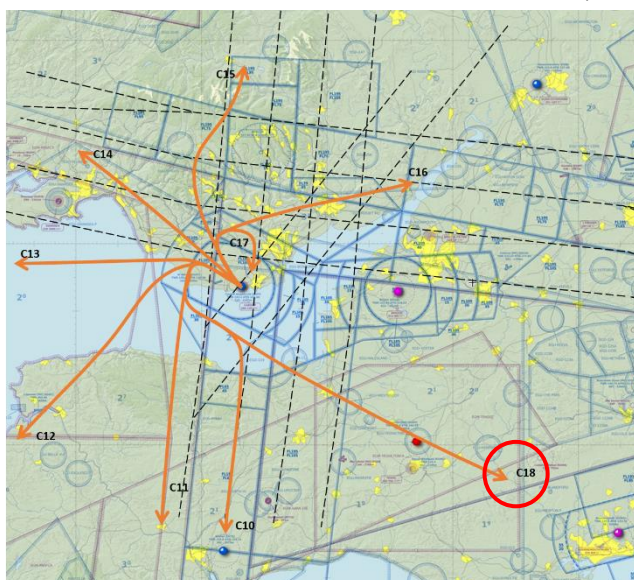


Climb is contained entirely within current controlled airspace.

The track mileage is increased by this route, which is operationally complex to integrate with arrival routes and is not favoured by airline representatives during engagement.

Potential Benefits
<p>Within current CAS structure (DP8)</p> <p>No GA concerns (within existing airspace) (DP7)</p> <p>Avoids populated areas and could be as high as 7/10K over the airfield (DP5)</p> <p>Should easily join the onward enroute network (DP1)</p> <p>Continuous climbs (DP3, DP4)</p>
Potential Issues
<p>Very likely conflict with Cardiff inbounds (DP0, DP11)</p> <p>Not an efficient route, excessive fuel burn and track miles (DP3, DP4)</p> <p>Wrap-around procedure is operationally complex (DP0, DP1)</p> <p>Less options for departure splits (DP2)</p> <p>Lose the ability to radar separate – safety concern (DP0)</p> <p>Potential conflict with Exeter departures (DP11)</p>

SID C18 – RWY 30 departure to the south-east. The climb out follows current tracks used by the EXMOR departure (EXMOR 1A), followed by a turn to the south-east. The remaining climb is over the Bristol Channel where levels above FL70 are anticipated.



The current departure route to the south east is via BCN, so there is a benefit in fuel saving and reduced track mileage.

Similar to option C9, if this route is used at any time other than during early morning periods, there may be an impact on military activity. The route also leaves controlled airspace shortly after crossing the coast in the region of Bridgwater, although levels attained will result in little impact from GA activity. Consideration will also have to be given to how the route joins with the network in the region of Bournemouth.

Potential Benefits
<p>More direct than the current dogleg towards BCN; fuel saving for airlines (DP3, DP4)</p> <p>No impact on paragliding (DP7)</p> <p>Early height benefit from turn (particularly when compared to Runway 12 east SID) (DP5)</p>
Potential Issues
<p>Large military impact – if operational H24 (DP6)</p> <p>Potential difficulty with integrating into the network (DP1)</p> <p>Likely interaction with Bristol arrivals (DP11)</p> <p>Incredibly busy area of airspace in the morning (DP1, DP2)</p> <p>May require new controlled airspace (DP8)</p>

Option Development – Holding

Holding does not happen regularly for Cardiff arrivals and only really occurs for weather issues, training flights or rare heavy traffic. Typically, more than 3 arrivals within approximately 15 minutes would necessitate holding. Weather issues are more likely to induce holding, which is fairly regular.

Currently, controllers are often very accommodating in allowing arrivals to just hold around an arbitrary fix for ease and fuel saving. A holding capability would help to future-proof airport capacity growth.

A Point Merge procedure has been considered as a delay absorption mechanism however, it is agreed that it would not be appropriate for Cardiff Airport. A Point Merge procedure is typically used for busier traffic flows and it would require a huge amount of new controlled airspace (CAS). GA representatives confirmed that a Point Merge would hugely impact their operations, not preferable at all as an option from their perspective.

In the Statement of Need for this ACP, it references the potential for a shared Cardiff and Bristol Hold, so this option is explored within these design options. A Hold to the south-east could provide an opportunity for a shared Cardiff/ Bristol Hold with the added benefit of less airspace required (across two Holds). This would need to be developed to determine who would control this and how flights would be allocated across different levels etc.

A Hold close to final approach would be beneficial for airlines, particularly if the weather suddenly improves and is no longer required. A Hold location to the south/south east of the airport would be optimal in relation to traffic flows (the vast majority of arrivals are from the south and east)

A Hold in the overhead would align most with current procedures, however there is a known radar issue ("cone of silence") where traffic is "lost" due to the close proximity in the overhead of the airport.

A Hold to the north may take aircraft out of the way of other Cardiff traffic, but it would need to be explored who would control a Hold in this region. The descent to landing could also be positioned over the Channel thus less noise impact. The area to the north-west of Cardiff is known to be a quiet section of airspace. However, there is a wind-farm development due to take place in this region which could affect this.

Discussions have been held with Bristol Airport and NERL on the potential maximum Hold level if both Cardiff and Bristol Airports were holding inbounds at the same hold. This is wholly dependent on enroute network above and available levels.

Stansted and Luton used the same Hold for years where there was a single delegated holding facility to assign levels to all holding inbounds. Heathrow and Northolt also share a Hold at times. Birmingham Airport has an alternate Hold which is shared by Manchester and London inbounds.

Design Work: Hold and Indicative Transition Options

All Hold options should be assumed to have a base level of 7,000ft. The Hold and transition options pose no major concerns for heliport operations and are generally very low impact for GA, however, if the airspace were drastically reduced, then this could create an issue.

Indicative options for transitions have been included but are subject to further design work.

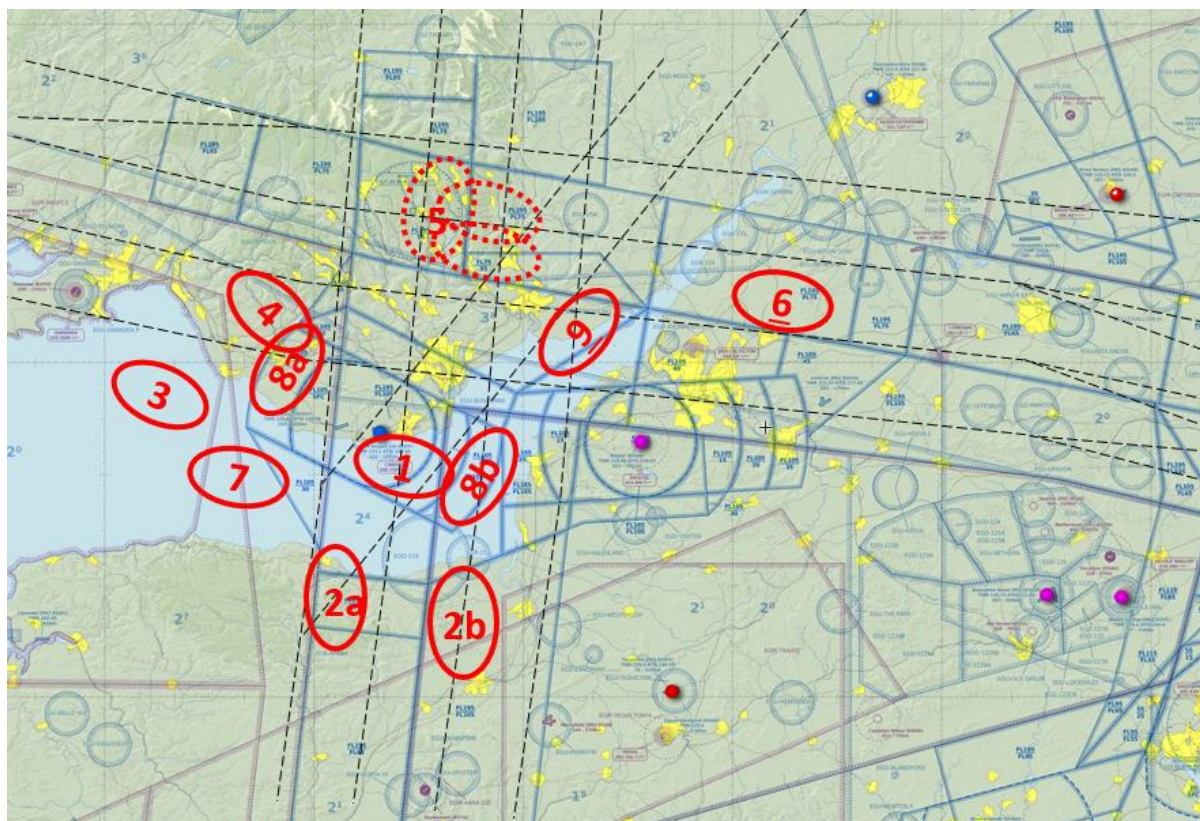


Figure 4: Cardiff Airport Hold Options

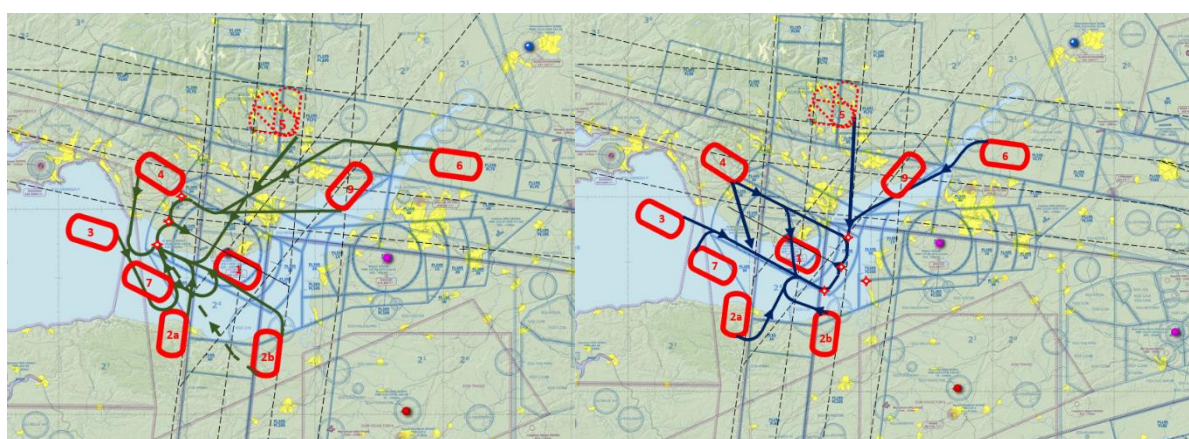
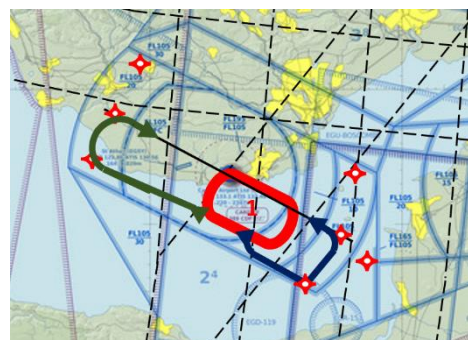


Figure 5: Cardiff Airport Runway 12 (left) and Runway 30 (right) Hold and Transition Options

Hold 1: Located in the current location of the CDF hold (overhead the airport), the new hold would be a fix based on satellite navigation, rather than a ground-based radio navigation aid. This location has benefits in that it is not intended to change any current tracks over the ground, can still be used effectively by training organisations using low performance aircraft and provides for a close in option for airlines holding off due to technical malfunctions, or awaiting weather improvement.



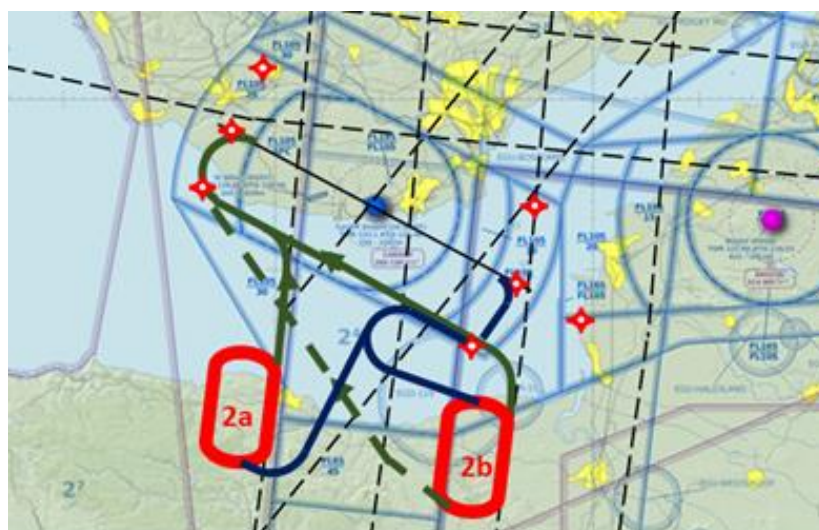
Due to the location of the Cardiff Radar being on the airfield, primary radar contacts of aircraft close to the holding fix will be lost in the “cone of silence” above the radar head. Departures from RWY 30 should not be affected. Departures from RWY 12 may be restricted when departing to the south, less so if turning north.

Potential Benefits

No impact for Cardiff Heliport operations (DP11)
No change from today (as per current procedure) (DP1)
Hold location has no impact on paragliders (operate at cloud base, around 4,000ft) (DP7)
Runway 12 transition over water (DP5)

Potential Issues

There is a known radar issue where traffic is “lost” due to the close proximity of traffic holding in the overhead of the airport. Cardiff Airport wants to alleviate this safety concern which this option would not do (DP0).
Increased workload from more vectoring (rather than leave traffic on its own transition) (DP0)
Runway 12 transition from Hold 1 would impact GA operations in this area (DP7)



Hold 2A: This hold is well situated for arrivals from the south, one of Cardiff’s two prime directions. The hold is relatively close to the airfield allowing for aircraft to react quickly to changing weather conditions.

This location may affect departures from Cardiff and Bristol depending on the exact location and direction of turn at the holding fix, and where departures join the network.

Any hold for Bristol to the east of this location will add further restrictions to departing aircraft.

Transitions from the hold will be contained over the Bristol Channel, but will need to be tactically managed against departures to the south.

Potential Benefits

Existing CAS, already goes down to 4,500ft (DP8)
 Minimal impact on MoD (DP6)
 Minimal GA impact. The high terrain over north Devon (west of Hold 2A) means GA traffic often avoids this area anyway. (DP7)
 Transitions over water (DP5)
 Appropriate location for the vast majority of arrivals which are from the south and east and in close proximity to the airport (minimal fuel burn) (DP3, DP4)

Potential Issues

Possible impact on Exeter departures (Hold protection area). The Hold may also take up levels which Exeter traffic uses. (DP11)

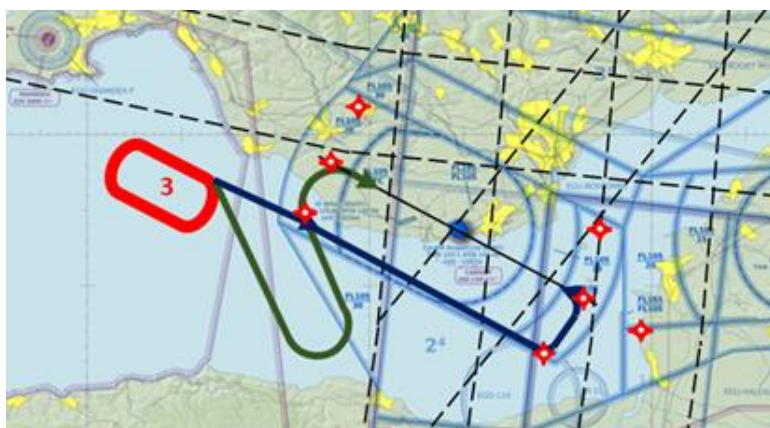
Hold 2B: Hold 2B has similar benefits to 2A, it is close to Cardiff and transitions route over the Bristol Channel. It also benefits from being a possible location for a shared hold with Bristol and permits departures with room to climb to the west of the holding position. As with 2A, it would need a tactical resolution with departures to the south and transitions from the hold, notably to RWY 12, although it should be possible to geographically separate transitions and departures when RWY 30 is in use. Bristol departures from RWY 27 will also be affected by transitions.

Potential Benefits

Minimal impact for GA/heliport users which generally avoid this area due high terrain/water (DP7)
 Transitions over water (minimal noise impact) (DP5)
 Utilises existing CAS (DP8)
 Minimal impact on MoD (DP6)
 Potential for use as a shared Hold with Bristol (DP1)
 Appropriate location for the vast majority of arrivals which are from the south and east and in close proximity to the airport (minimal fuel burn) (DP3, DP4)

Potential Issues

Runway 12 transition likely to impact on Bristol departures (DP11)
 Possible impact on Exeter departures (Hold protection area). The Hold may also take up levels which Exeter traffic uses. (DP11)
 Cardiff departures would potentially have to be held underneath (DP11)



Hold 3: The benefit of this location is its position over the sea, leading to the transitions also being contained over the sea for much of the approach to RWY 12 and all of the approach to RWY 30.

The location is however away from the main arrival directions to Cardiff which are predominantly from the south and east, leading to the requirement for aircraft to plan

greater fuel loads which in the main will not be required. Any use of the hold will lead to large track distances for aircraft approaching from the east, north and south. A large area of new controlled airspace would also be required to accommodate the hold.

Transitions to RWY 12 can be separated from all RWY 12 departures. RWY 30 transitions will require tactical intervention to integrate with departures to the south.

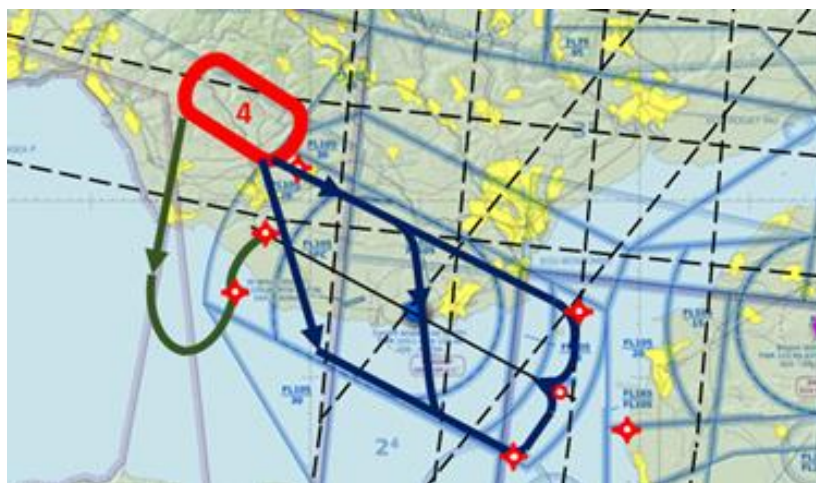
Potential Benefits

Runway 12/ 30 transitions from Hold 3 would have no impact on GA operations (DP7)

Hold location has no impact on paragliders (operate at cloud base, around 4,000ft) (DP7)
Transitions over water (minimal noise impact) (DP5)

Potential Issues

Impact on MoD operations (aerobatics/ spinning). Fast jets operate around here, from Valley. (DP6)
Impact on GA operations due to hold protected area (spinning activities) (DP7)
Runway 12/ 30 transitions would require new CAS for protection (north and east) (DP8)
Does not suit general flow of traffic (from south & east) and transitions would introduce additional track miles (DP1, DP3 & DP4)



Hold 4: This hold location benefits arrivals from the west more than any other direction. Most arrivals are from the east and south, so this would add track miles, associated fuel burn, and higher planned fuel loads for arrivals from the east and south. The presence of a large windfarm beneath this location may result in clutter issues on ATC radar displays.

The area immediately to the south west of the hold location is used by both military and GA for spinning and general handling, so associated controlled airspace required to accommodate the hold will place restrictions on these activities.

Transitions from the holding facility to RWY 12 are contained mostly over the sea at lower levels. The trombone style transition can be used to sequence aircraft but will require additional airspace over the sea to the West of Cardiff.

Multiple transition options are available for arrivals to RWY 30. The route to the south allows separations to be systemised against turns towards the North but will require tactical management against departures turning South.

A transition through the Cardiff overhead to the South permits arrivals to be held higher and allowing for less restricted climb to be given to aircraft turning right from RWY 30. Primary tracks may be lost for a short period as aircraft route through the radar overhead. The transition following a downwind right-hand pattern keeps arrivals in radar cover but may have an impact on Bristol departures from RWY 27 routing North-West.

Potential Benefits

No impact for Cardiff Heliport operations (DP11)
South-east transition could be tweaked to avoid requiring more CAS (DP8)

Potential Issues

Impact on MoD operations (aerobatics/ spinning) – both the Hold location and Runway 12 transition (DP6)
Runway 12 transition would descend over populations (DP5)
Runway 12/ 30 may require additional CAS (DP8)
Hold transitions could heavily impact upon gliding/ paragliding which operate around the hills at cloud base

High ground in this area means GA are generally operating at higher levels (closer to Hold and transitions) (DP7)
 Fixed wing GA impact (GA spinning activities) (DP7)



Hold 5 - around BCN (RNAV point). This hold is contained entirely within current CAS, so no extra restrictions to GA or military airspace users. The exact hold orientation could be along the planned network routes, either in a north/south, or east/west direction. It is envisaged only a single orientation would be used, due to the protected areas required around the hold.

This hold location would serve arrivals from the North, West and East well, although demand for arrivals from the North and West is lower than from the South and East. Arrivals from the South using this location will have to plan to carry higher fuel loads with the associated extra fuel burn, not only in carrying fuel, but also in transiting past Cardiff to the hold location.

Transitions are contained over the land but use of PBN will enable accurate track keeping avoiding local population densities. Departure routes from Cardiff should be able to be procedurally separated, notably by use of specified climb gradients for departures and level restrictions on arrival and departure routes.

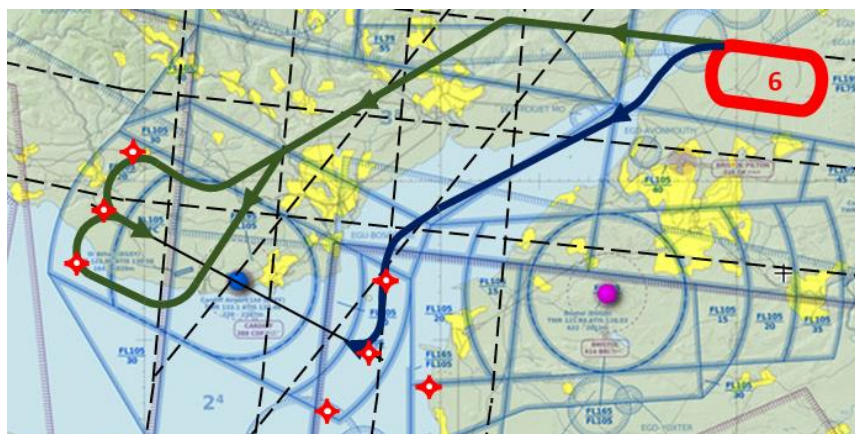
The transition to RWY 12 can be varied to accommodate this, with options for either remaining to the North, or maintaining a higher level and crossing through the overhead to position onto a downwind leg to the south. Bristol arrivals to RWY 09 and departures from RWY 27 may be affected, particularly by arrival transitions to Cardiff RWY 30.

Potential Benefits

Within existing CAS (DP8)
 Minimal GA impact - above higher ground which GA users tend to avoid anyway (except gliders – see below) (DP7).
 No impact for Cardiff Heliport operations (DP11)
 Different options for Runway 12 transitions (overhead or joining a trombone to the north-west of Cardiff) (DP1)
 Minimal MoD impact (DP6)

Potential Issues

Increased track miles (in particular for arrivals from south) (DP3, DP4)
 Transitions may be problematic for gliders. All the airspace between the Hold location and Cardiff Airport is used by gliders, at around 4,000 – 5,000ft but they have been known to reach 6,000ft. There are a huge number of sites across the Welsh Valleys. The current airspace base is 5,500ft (DP7).



Hold 6: This location closely resembles an option proposed by Bristol, providing the option for a shared facility. The hold is contained within current controlled airspace and will not affect GA, or military operations.

The location is only well located for arrivals from the east, leaving all other

directions with extra fuel burn, track mileage and fuel planning considerations.

Due to the distance from Cardiff, the hold only provides for ATC delay management. The location provides little option for airlines holding off due to weather, to react in a timely manner to changes in weather.

Transitions from the hold can be separated procedurally from Cardiff departures, but there may be an impact on arrivals to Bristol RWY 09 which will follow a similar track to Cardiff arrivals to RWY 30. Departures from Bristol RWY 27 in a north, or north-westerly direction will also require tactical intervention against arrivals to Cardiff RWY 30. The transition to RWY 12 can be varied, with options for either remaining to the North, or maintaining a higher level and crossing through the overhead to position onto a downwind leg to the south.

In a similar way to transitions from Option 5, tracks over the ground can be designed to provide least disturbance possible to local populations.

Potential Benefits

- Hold is within existing CAS (DP8)
- No impact for Cardiff Heliport operations (DP11)
- Minimal MoD impact (DP7)
- Potential to be a shared Hold with Bristol Airport (DP1)

Potential Issues

- Transition to Cardiff may require additional CAS (lower bases) (DP8)
- Runway 12 transition may interact with Cardiff departures (DP1)
- Runway 30 transition will likely have an impact on Bristol operations (DP11)
- Impact from the transition would be a concern for GA users, rather than the Hold location - lots of cross-country flights operate in this region (Cotswolds) and often quite high up to 7,000ft – transitions from Hold could also impact upon these flights (DP7)



Hold 7: This is a preferred option for a hold location for Cardiff ATC. It is close to the airfield providing for ATC delay management, quick reaction by aircraft to changing weather conditions, or holding off for technical/emergency reasons. The position suits arrivals from the south, one of the more frequently serviced directions. Arrivals from other directions will have longer track mileage and associated fuel burn.

The hold is located over the sea, providing clear noise benefits for the local population. Transitions from the hold are also contained entirely over water for approaches to RWY 30 and cover only a short land crossing when positioning for RWY 12. This however will not be a considerable change from current radar circuit pattern vectoring currently used.

Tactical intervention will be required to separate RWY 30 departures to the South from arrivals to RWY 30 descending in a south-easterly direction from the hold. On all other routes, geographical separation will be possible.

Potential Benefits

No impact for Cardiff Heliport operations (DP11)
 Lesser impact on MoD operations which cross the channel at around 6,000ft then descend (in existing CAS). Transitions from here also shouldn't be a concern. Less MoD impact than Holds 3 and 4. (DP6)
 Runway 12/ 30 transitions from Hold 7 would have no impact on GA operations (DP7)
 Transitions over water (DP5)

Potential Issues

Runway 30 transition likely requires new CAS (DP8)
 Extra track miles for eastern arrivals (inefficient) (DP3 & DP4)



Holds 8A & 8B

Holds 8a and 8b are dependent upon runway in use as detailed below.

Hold 8A: This hold is intended to be used for arrivals to RWY 12. The lowest holding level will need to be lower than options further out due to the shorter track distance from hold to landing. The benefit of this location is a reduced impact on the departure tracks at low level, although routes inbound to the hold location from the network will have to be considered as the arrivals from both southerly and easterly directions will cross tracks of departures in these directions.

The close positioning of the hold to Cardiff Airport allows for flexible management of both ATC delay and reaction to changing weather conditions. There are also positive benefits related to track mileage, fuel burn and fuel planning for airlines, regardless of the direction from which the arrivals have originated.

However, any runway change following the point at which arrivals have received the Aerodrome Terminal Information Service (ATIS) information, will mean that the crews will be required to change to a hold that will not have been briefed, adding complications to flight operations at the latter stages of a flight

The location will result in the need for more controlled airspace to the North-West of Cardiff, having a direct impact on military and GA training activities.

Potential Benefits

No impact for Cardiff Heliport operations (DP11)

Hold location has no impact on paragliders (operate at cloud base, around 4,000ft) (DP7)

Potential Issues

Impact on MoD to the north-west due to additional CAS required (DP6 & DP8)

Transition to the north may have a noise impact on ground-based stakeholders (DP5)

Large impact on GA operations due to additional CAS required (DP7 & DP8)

Hold would need to be at 4,000ft to accommodate track mileage for approach (DP5)

Only effective if combined with Hold 8b (DP1)

Late runway changes would have significant cockpit workload (DP0)

Hold 8B

This hold is intended to be used in conjunction with Option 8a, but for arrivals to RWY 30. Again, holding levels will be low enough to accommodate the shorter track distance to the runway.

The location is contained over the Bristol Channel and transitions can be restricted to over-water tracks, having an environmental benefit related to noise on the surface. There are also positive benefits related to track mileage, fuel burn and fuel planning for airlines, regardless of direction of arrival.

Interaction with arrival routes will not be as great as Option 8a, but the location will have a direct impact on arrivals to Bristol RWY 09 and departures from RWY 27, forcing arrivals down early and restricting outbound climb to low altitude. Both of these eventualities will counter environmental benefits, leading to extra fuel burn and noise at lower altitudes if the hold is being utilised.

As with Option 8a, runway change will lead to flight deck operational complications associated with a hold swap and re-brief of the approach process.

Potential Benefits
<p>Contained with CAS (DP8)</p> <p>Less concern for MoD than Hold 8A (DP6)</p> <p>No impact for Cardiff Heliport operations (DP11)</p> <p>Hold and Runway 12/ 30 transitions from Hold 8b would have no impact on GA operations (DP7)</p> <p>No impact on Exeter operations (DP11)</p>
Potential Issues
<p>Huge impact on Bristol Airport operations (DP1, DP11)</p> <p>Transition may be over Cardiff city (noise) (DP5)</p> <p>Hold would need to be at 4,000ft to accommodate track mileage for approach (DP5)</p> <p>Late runway changes would have significant cockpit workload (DP0)</p> <p>Only effective if combined with Hold 8a (DP1)</p>



Hold 9: This hold option permits arrivals to be able to react to changes in weather conditions or manage technical issues more effectively than if using holds further to the North, or East.

The hold is contained partly over land, but the area is sparsely populated and holding levels would be at a level where noise nuisance on the ground is minimised.

The proposed location will affect departures from Bristol RWY 27 routing in both a northerly and easterly directions, restricting continuous climb. Transitions from the hold will also directly affect Bristol departures requiring tactical intervention where the tracks cross.

Transitions from Option 9 to Cardiff RWY 30 can be separated geographically from all RWY 30 departures. Transitions to Cardiff RWY 12 will cross all departures turning North-West, North, and North-East from RWY 12. The transition to RWY 12 has options for either remaining to the North of Cardiff, or routing to the South. The latter may assist in reducing the interaction with Cardiff departures turning in a northerly direction.

Potential Benefits

- Serves arrival locations from the east (DP1, DP2)
- Good integration with the network (DP1)
- Locations close to Cardiff allows airlines to react quickly to changing conditions (DP1)

Potential Issues

- Impact from the hold would be a concern for GA users, rather than the Hold location - lots of cross-country flights operate in this region (Cotswolds) and often quite high up to 7,000ft – transitions from Hold could also impact upon these flights (DP7)
- Significant impact on Bristol operations (DP1, DP11)

Standard Arrival Route (STAR) Procedures

A STAR is a published IFR ATS route by which aircraft should proceed from the en route phase to a Hold.

The proposed positions of Holds are reproduced in the diagrams below, along with indications of the approximate alignment of STARs (in orange). However, these are indicative only; the links from the en route network and the resultant design of STARs will be the responsibility of the en route operating authority (NERL), albeit in consultation with the airports.

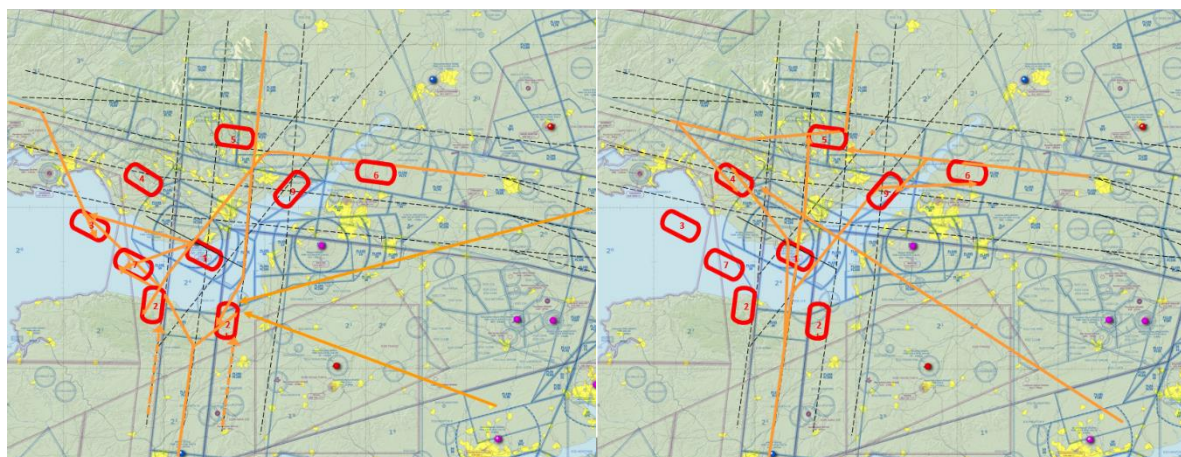


Figure 6: STARs to southern and northern Holds



Figure 7: STARs to Holds 8a and 8b (dependent on runway in use)

Conclusion and Next Steps

We have shown that we have engaged with appropriate stakeholders – airlines, MoD, GA, and airport stakeholders, and this has resulted in comprehensive discussions on the possibilities for the airport.

There are a vast number of potential options available for the airport procedures, with numerous possibilities for departure and holding procedure combinations, and a variety of factors which could impact or be impacted.

This document has explored and described a proportional and reasonable number of options, which have been explored with stakeholders through the process documented here.

The next document, *Step 2A(ii) Design Principle Evaluation*, will evaluate the design options listed in this document, reducing the longlist to a shortlist for appraisal.

Presuming approval of Stage 2, Cardiff Airport will continue to mature the design options presented herein once starting Stage 3 of the CAP1616 process. This will involve constructing “scenarios” of different design option combinations i.e., different SIDs and Holds. This will allow us to analyse interactions between different design options and which combinations best meet our Design Principles. We look forward to engaging our stakeholders during this next phase and working towards an optimal design for Cardiff Airport and our stakeholders.

Annex A: Cardiff Airport Design Principles

Theme	Design Principle and Priority	Details
Safety	<p>DP0 Safety: Must maintain or where possible, enhance current levels of safety</p> <p>Priority: high</p>	<p><i>Safety is at the forefront of everything Cardiff Airport does. Safety will underpin any airspace change which where possible, will enhance current safety standards. Cardiff Airport also believes it is crucial that any proposed changes do not have a detrimental safety impact on other airspace users.</i></p>
Operational	<p>DP1 Resilience: The proposed airspace must maintain or where possible, enhance operational resilience of the ATC (Air Traffic Control) network and operations</p> <p>Priority: high</p>	<p><i>Cardiff Airport will consider airspace and route designs that support – if not improve - the resilience of the airport and national air traffic network; benefiting associated airspace users.</i></p>
Operational	<p>DP2 Capacity: The proposed airspace design will yield the maximum capacity benefits from systemisation in line with the CAAs (Civil Aviation Authority) published airspace modernisation programme</p> <p>Priority: high</p>	<p><i>Cardiff Airport's airspace change, in conjunction with the FASI-S programme and in accordance with the airspace modernisation programme (CAP1711), will need to respond to future growth opportunities. Any changes to airspace or procedures must be able to cope with an increased demand and link efficiently into the network; for the benefit of those who use and are affected by UK airspace.</i></p>
Economic	<p>DP3 Network Performance: The proposed Cardiff FASI-S (Future Airspace Strategy Implementation – South) airspace should facilitate optimised network economic performance</p> <p>Priority: medium</p>	<p><i>Cardiff Airport, through improved airspace and procedure designs, will seek to drive growth through environmental and operational improvements e.g., track mileage, route charges, fuel burn and associated emissions.</i></p>
Environmental	<p>DP4 Greenhouse Gas Emissions (CO₂): The proposed Cardiff FASI-S airspace should minimise CO₂ emissions per flight</p> <p>Priority: medium</p>	<p><i>Cardiff Airport is committed to minimise environmental impact through the most efficient proposed airspace and procedure design. This covers both CO₂ emissions and associated fuel burn.</i></p>
Environmental	<p>DP5 Noise impact to stakeholders on the ground: The proposed Cardiff FASI-S airspace should limit, and where practicable reduce, noise impacts to stakeholders on the ground.</p> <p>Priority: medium</p>	<p><i>Considerations/options to mitigate the impact of noise include (in no particular order):</i></p> <ul style="list-style-type: none"> - <i>Using more noise efficient operational practices</i> - <i>Minimising number of people newly overflown</i> - <i>Maximising sharing through predictable respite</i> - <i>Avoid overflying communities with multiple routes</i> - <i>Maximising sharing through managed dispersal</i> - <i>Minimising total population overflown</i>

Theme	Design Principle and Priority	Details
		<ul style="list-style-type: none"> - Designing flight paths over commercial and industrial areas - Prioritising routing flight paths over parks and open spaces (rather than over residential areas)
Technical	DP6 Airspace Access and Integration (MoD Requirements): The Cardiff FASI-S Airspace Change Proposal should minimise impacts on the MoD Priority: medium	Cardiff Airport's proposed design will take into consideration the requirements of the military. The MoD will be involved and engaged with throughout the process, particularly in design work which may propose changes to airspace or procedures.
Technical	DP7 Airspace Access and Integration (GA Impacts): The Cardiff FASI-S Airspace Change Proposal should minimise impacts on GA and other civilian airspace users Priority: medium	In accordance with the Airspace Modernisation Strategy, Cardiff Airport should consider an Airspace Change Proposal that facilitates and accommodates access to airspace for GA and other civilian airspace users such as emergency service traffic and training flights.
Technical	DP8 Airspace Access and Integration (Minimise CAS): The volume and classification of controlled airspace required for the Cardiff FASI-S ACP should be the minimum necessary to deliver an efficient airspace design, taking into account the needs of all airspace users Priority: medium	Cardiff Airport's proposed design, including any changes to controlled airspace, will ensure the delivery of a safe and efficient operation. The reference to "other airspace users" covers adjacent aerodromes, General Aviation users and the MoD; amongst others.
Technical	DP9 Use of Advanced Navigation Technology (PBN): The route network linking airport procedures with the enroute phase of flight will be designed to yield maximum safety and efficiency benefits by using an appropriate standard of PBN. Priority: high	Cardiff Airport will remove the dependencies on legacy navigational aids and will comply with the requirements of known PBN implementing rules. Changes to arrival and departure routes will be designed to make full use of modern navigation technology. Any changes to airspace or systems will have back-up procedures in place.
Policy	DP10 Use of Advanced Navigation Technology: The proposed Cardiff FASI-S airspace design must be compliant with all relevant laws and regulatory requirements. Priority: high	Cardiff Airport will ensure accordance with all relevant policies – such as the PBN Implementing Rule – for compliance and maintenance of safety standards.
Technical	DP11 Airspace Access and Integration (Impact on Adjacent Airfields/ Aerodromes): The proposed airspace should where possible, achieve a	Cardiff Airport will engage with surrounding airfields throughout their design work to mitigate the impact on neighbouring airports such as Bristol Airport, Exeter Airport, St Athan and Cardiff Heliport.

Theme	Design Principle and Priority	Details
	<p>mutually beneficial solution to surrounding airfields ensuring equitable access to the airspace 'shared' with Bristol Airport</p> <p>Priority: high/ medium</p>	

Annex B: Cardiff Airport Engagement

The following meetings were also attended by Cardiff Airport in relation to the wider programme of airspace modernisation which they are part of. They have been separated from the above design workshops as they were focussed on providing updates across the different various ACPs and the wider UK programme of airspace change.

Engagement Activity	Date	Participating Stakeholders	Summary of Engagement
LD1/ Cardiff engagement meeting	17/12/2020	ACOG, Cardiff, NERL	NERL provided an update on their design work and specifically changes will may benefit Cardiff traffic. Further discussion on the delegated function at Cardiff Airport and how this may be impacted.
LD1/ Bristol/ Cardiff engagement meeting	28/01/2021	ACOG, Bristol, Cardiff, NERL	NERL provided an update on their design work using the DesignAir visualisation tool. Cardiff and Bristol provided feedback on the latest LD1.1 designs such as incorporation with their own future changes.
LD1/ Bristol/ Cardiff design workshop	25/02/2021	ACOG, Bristol, Cardiff, NERL	NERL presented an update on their West Airspace design and welcomed feedback from Bristol and Cardiff. Design update included systemised traffic flows, delegated airspace and Holds. Feedback taken forward to upcoming development sims.
LD1/ airports system requirements engagement meeting	26/03/2021	Bristol, Cardiff, Exeter, NERL	Discussion on which airport systems will be impacted by the West programme deployment. Cardiff noted their own systems including EFPS, radar displays and their simulator.
LD1/ Cardiff engagement meeting	15/04/2021	Cardiff, NERL	NERL provided an update on latest LD1.1 design and potential benefits for Cardiff Airport including a more predictable presentation of traffic. Cardiff provided update including access to Department for Transport (DfT) funding.
LD1/ Bristol/ Cardiff engagement meeting	26/04/2021	ACOG, Bristol, Cardiff, NERL	LD1 design team provided an update following their development sims. Discussion and feedback received on various elements of LD1 design including truncation of Cardiff SIDs and potential raising of airspace bases. Further development sims planned.

Engagement Activity	Date	Participating Stakeholders	Summary of Engagement
LD1/ Cardiff/ Bristol engagement meeting	24/05/2021	ACOG, Bristol, Cardiff, NERL	Participants each provided an update on their design work. NERL (LD1) design at a more mature phase; the design team welcomed feedback on their planned interface with Cardiff and Bristol traffic.
Masterplan briefing	17/06/2021	ACOG, Bristol, Cardiff, Exeter, MoD	ACOG provided an update on the development of the airspace change masterplan including the plan for several iterations. The requirements on ACOG and change sponsors were explained, such as working together to identify dependencies between ACPs.
Update on NERL Sim Output	21/06/2021	Bristol, Cardiff, NERL	NERL provided an update on their simulation output including feedback from Cardiff and Bristol traffic runs.
LD1/ Cardiff/ Bristol engagement meeting	28/06/2021	ACOG, Bristol, Cardiff, NERL	Progress on individual ACPs provided. NERL provided an update on the output from a "mini-sim" they had run including potential changes to their design.
West deployment programme coordination meeting	06/07/2021	ACOG, Bristol, Cardiff, Exeter, NERL	ACOG provided an update on the Masterplan and deployment planning. Cardiff provided an update on their Stage 2 design work and flagged concerns about the DVOR programme timeline again.
LD1 engagement workshop	25/07/2021	ACOG, Bristol, Cardiff, Exeter, NERL	Update on LD1 design provided. Principal of doing a combined assessment between Cardiff and Bristol was supported (with potential for Exeter to join).
LD1/ Cardiff/ Bristol engagement meeting	10/09/2021	Bristol, Cardiff, NERL	NERL update that LD1.1 has passed through Stage 3 and their consultation is live. Discussion held on how Cardiff and Bristol traffic will utilise new en route routes.
West Programme Sim/ Safety Meeting	29/09/2021	ACOG, Bristol, Cardiff, Exeter, NERL	Discussion on upcoming safety and simulation activities.
West Deployment Programme Coordination Meeting	16/11/2021	ACOG, Bristol, Cardiff, Exeter, NERL	Updates on different ACPs provided. Various elements of upcoming CAP1616 stages discussed included simulations, safety work and overall timelines. ACOG provided update on upcoming Masterplan Iteration 2.
NERL West/ Severn Group Airports	07/01/2022	ACOG, Bristol, Cardiff, Exeter, NERL	NERL provided a summary on their LD1.1 consultation including responses received. As a

Engagement Activity	Date	Participating Stakeholders	Summary of Engagement
Engagement Meeting			result of consultation feedback, NERL provided an update and justification on a revision to the LD1.1 design.

Annex C: Glossary

ACOG	Airspace Change Organising Group
ACP	Airspace Change Proposal
AIAA	Area of Intense Aerial Activity
ANSP	Air Navigation Service Provider
ATC	Air Traffic Control
BCN	Brecon
CAA	Civil Aviation Authority
CAS	Controlled Airspace
CTA	Control Area
DfT	Department for Transport
FASI-S	Future Airspace Strategy Implementation - South
GA	General Aviation
ILS	Instrument Landing Strip
IFR	Instrument Flight Rules
NDB	Non-Directional Beacon
NERL	NATS En Route Ltd
NM	Nautical Mile
RNAV	Required navigation (Area Navigation Basic 5nm Precision 1nm)
SID	Standard Instrument Departure
SoN	Statement of Need
STAR	Standard Arrival Route
VFR	Visual Flight Rules
WTA	West Terminal Airspace