Inverness Airport ACP – supplemental emissions assessment

Background

This note summarises the additional emissions assessment carried out for the Inverness ACP to take into account the extra track miles which are currently flown by some arriving aircraft when the radar service is unavailable. Inverness ATC advised that in the early morning and late evening periods, arrivals that follow soon after an earlier arrival (i.e. within 10 minutes) will not fly the standard vectored arrival route, i.e. within the swathes described in the previous report. Instead they will be instructed to fly directly from the beacon to a point overhead the airport, execute a 'loop' circuit followed by entry into the hold above the airport, and then after one or two hold circuits fly outwards from the airport to turn back onto the standard approach path. This special procedure ensures sufficient separation between consecutive arrivals but as a result, significant extra track distance is covered by the affected aircraft leading to additional fuel burn.

We have therefore re-modelled the 'without ACP' scenario for both the current and future (2019) cases to take into account the above special procedures. It should be noted that after implementation of the ACP, such arrival procedures necessitating extra track miles will not be needed.

Methodology

The likely combinations of loops and holds for individual flights within the data samples from 10 and 12 July 2013 were determined by Inverness ATC. The additional distance covered by aircraft using the loops and holds was then calculated for the affected arrival movements. The non-vectored arrival routes are significantly longer than those used when radar assistance is available, and also longer than the proposed ACP routes. On average the non-vectored arrival routes are 63 nm from the beacon (range: 44-77 nm), while those assisted by radar are on average 33 nm (range: 27-43 nm); the proposed STARs are on average 35 nm (range: 24-46 nm).

The special arrival procedures would lead to a change in the approach height profiles, in particular with respect to the loops and holds. Only the E170 and A319 aircraft types were found to produce significant differences overall in fuel consumption when using the non-vectored arrival tracks, therefore the fuel consumption per nautical mile for these two types was adjusted over the length of the loops and holding circuits to take into account the different flight profile. For simplicity we have assumed that the loops and holds are flown at a height of 4000 ft. The other aircraft which typically fly into Inverness when the radar service is not available, namely the SF34, L410, D328 and C172, were found to produce only relatively small changes in fuel consumption, so no profile adjustments were made for them.

Results

The calculated changes in annual fuel consumption and annual CO_2 emissions due to implementation of the airspace change for the current (2013) and forecast year 2019 scenarios are summarised below in **Table E3** below:

Table E3 Total annual changes in fuel consumption and CO_2 emissions resulting from airspace change

Scenario	**Total change in annual fuel consumption (t)**	**Total change in annual CO_2 emissions (t)**
Assuming central swathe tracks for 'without ACP' situation		
With ACP	+122	+387
Forecast 2019	+156	+498
Assuming outer swathe boundary tracks 'without ACP' situation		
With ACP	+23	+74
Forecast 2019	+30	+95
Assuming outer swathe boundary tracks and non-vectored arrivals (in early morning and late evening) for 'without ACP' situation		
With ACP	-104	-331
Forecast 2019	-126	-401

It can be seen that if the central 'average' swathe track is assumed for each of the current routes, the airspace change is expected to cause a net increase in annual CO_2 emissions of 387 tonnes, which will increase a further 29% to 498 tonnes by 2019.

If the outer swathe boundary is assumed as the track followed for each of the current routes, the net increase in annual CO_2 emissions due to the airspace change is significantly reduced, to 74 tonnes, rising to 95 tonnes by 2019. By including the extra track miles that are flown by some early morning and late evening arrivals for the 'without ACP' cases, there will be a net annual *decrease* in CO_2 emissions of 331 tonnes following the airspace change, decreasing further to 401 tonnes by 2019.