lCase Study – Arlanda Airport

Introduction to the airport

Stockholm Arlanda Airport is located in the Sigtuna Municipality of Sweden, approximately 37 km north of Stockholm and nearly 40 km south-east of Uppsala. It is the largest airport in Sweden and the third-largest airport in Scandinavia. In 2017 it carried approximately 27 million passengers, including 21,2 million international travellers and 5,5 million domestic travellers [1].

The airport has three runways – Runway 1 (01L/19R), Runway 2 (08/26) and Runway 3 (01R/19L) (see Figure 9.2). Runway 1 is 3,301 m long and can handle take-offs and landings by the heaviest, currently used aircrafts. Runways 2 and 3 are 2,500 m long. Runway 1 and 3 are parallel runways that can be operated independently of one another. Two runways (01L/19R and 08/26) were built in 1958 and 1959. At the end of 1980's and the beginning of 1990's, Stockholm Arlanda Airport started to plan the building of an additional – third – runway (01R/19L). A helicopter view of the airport is shown in Figure 1.

Figure 1: Location of the Stockholm Arlanda Airport [6]

Noise complaints at Stockholm Arlanda Airport were not much of an issue before 2003. There was not even the need to have a special organisation at the airport to handle noise complaints. The residential community living close to those two runways accepted the air traffic over their houses. When the third runway was built, the airport participated in meetings with the authorities, municipal leaders and representatives of the surrounding residential areas. Concerns regarding the noise exposure of densely populated areas at south of the airport were discussed. New and improved ways and technologies for navigating the air traffic were presented by the airport. The possibility to apply the curved approach instead of using the straight approach to the new runway was discussed as one option to reduce the noise exposure for the residential areas [6].

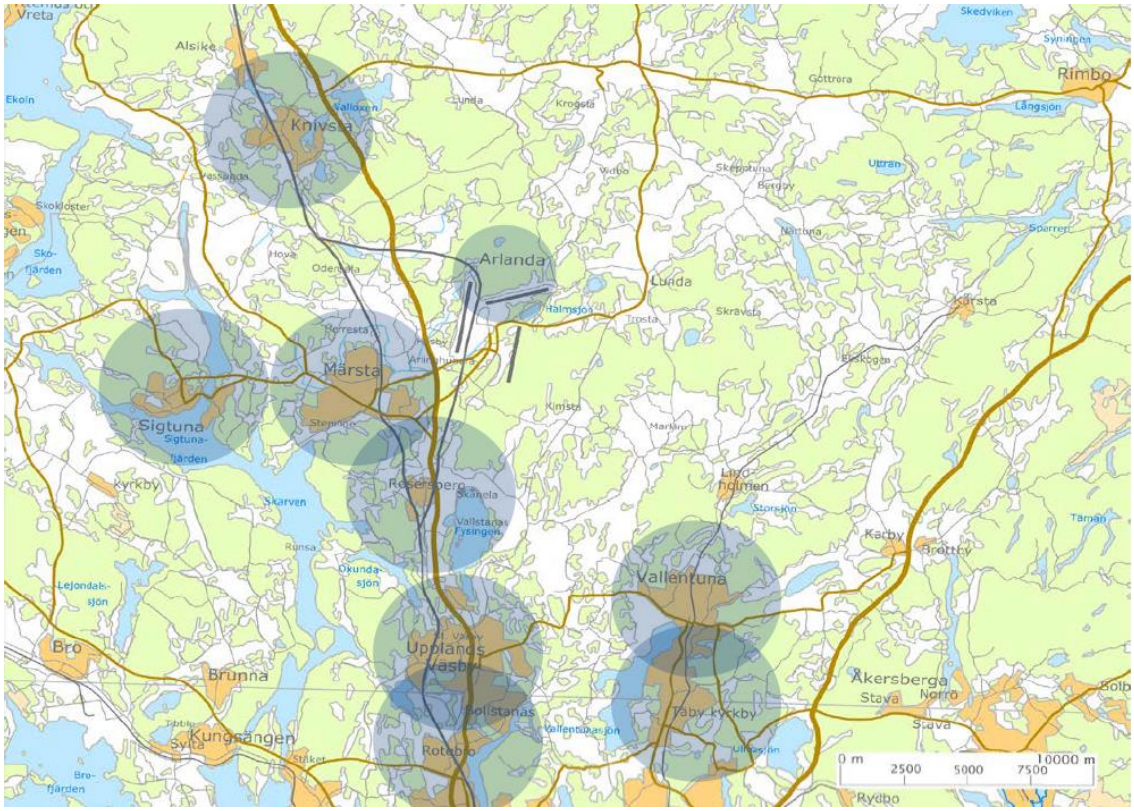

Figure 2: The location of Stockholm Arlanda Airport and the densly populated neigbourhouds [6]

An environmental permit is required for operating an airport in Sweden. Applied noise regulations at Stockholm Arlanda Airport are applied accordingly to the environmental permit, granted in 2015. This permit is operating since January 2016 and includes technical development conditions, noise insulation conditions for residential buildings and premises for care and education [4]. The noise contours for L_{den} 55 dB(A) for Stockholm Alranda Airport are illustrated in Figure 3. The blue noise contour in Figure 3 illustrates the permitted traffic volume of 3050 exposed residents. The green contour in Figure 3 corresponds to the traffic volume of 1950 exposed residents from 2008.

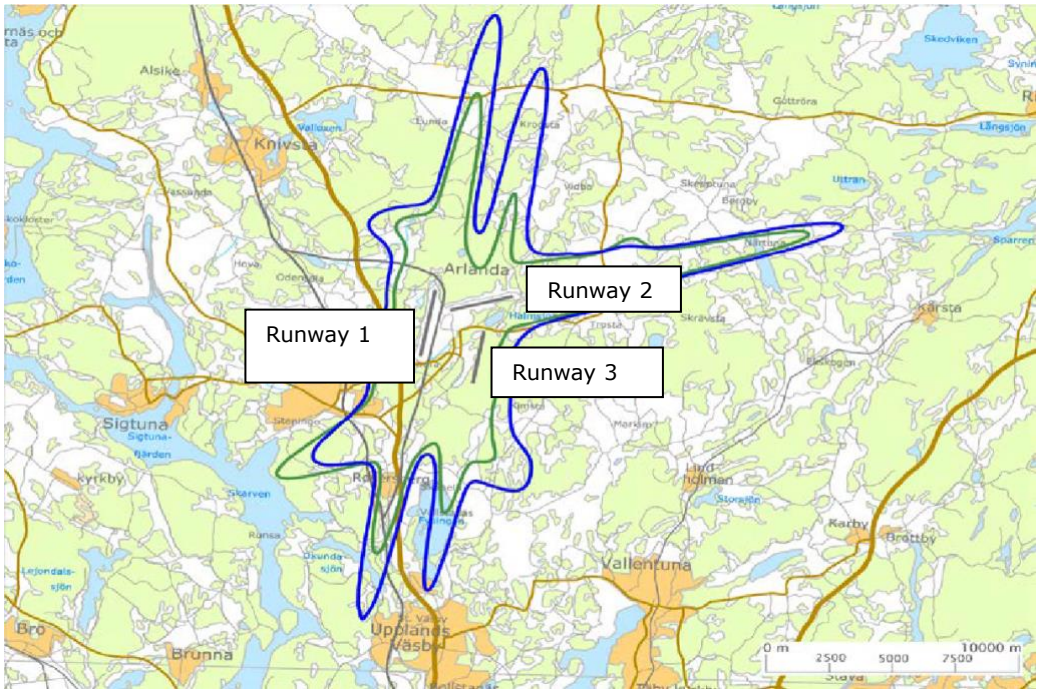

Figure 3: Noise contours for L_{den} 55 dB(A) for Stockholm Arlanda Airport

Approach to the Balanced Approach

a. The airport has an environmental permit containing a number of terms regulating the airport's activities. Among other terms there are several that regulate how the traffic should be handled when it comes to flight paths, use of runway combinations, noise levels, regulations for noise at disturbed areas to be avoided when possible, noise insulation, etc. The environmental permit has been determined in proceedings in the environmental court;
b. Review of National Action Plans and previous Balanced Approach interventions;
c. Identification of any trends and overarching processes and internal systems that underpin Balanced Approach implementation.

Stockholm Arlanda Airport annually compiles a Noise Management Plan (NMP), containing all activities regarding aircraft noise, highlighting on what the airport will work on during the year. The activities are spread over different departments of Swedavia, which is the airport owner. In the NMP it is stated that the airport follows the Balanced Approach and that the activities are in correlation. Besides points 1-4 of the Balanced Approach the airport has added two extra points – follow up and control, and communication. Follow up and control is done through noise mapping, noise calculations and noise measurements by airport's department for flight acoustics. Communication is basically the handling of noise complaints and communication with neighbours and surrounding communities.

Introduction to the intervention

With the aim of reducing the noise levels related to runway 3, steeper glide approach angles were applied. Two scenarios with different glide slope approaches were presented for the most commonly used type of aircraft.

Delve into the processes behind the case

Identification of the 'need'.

The Stockholm Arlanda Airport started to use the Runway 3 (01R/19L) in April 2003. The flight paths ran over densely populated areas south of the airport where additional residents were exposed to air traffic noise. A large amount of noise complaints were submitted to the airport almost immediately after they started to use the Runway 3. The sudden and high amount of complaints was a surprise for the airport and handling the complaints became a big challenge.

It was difficult to get the approval for the curved landing approach for the Runway 3 by the Swedish Transport Agency as many conditions and the international flight safety regulations [3] had to be fulfilled. In the end, the curved approach could not be used in practise because of the requirement of special education of the crew, the requirement of particular weather conditions and limited usage time (curved approach couldn't be used at peak times). The only option left was **to fly straight over the residential area** Upplands Väsby. This was especially problematic because Runway 3 was mainly used during the peak traffic hours in the early morning and early afternoon.

The residential community thought that the airport had lied to them and then, unexpectedly, high aircraft traffic made the community angry. The reasons for flying straight over the residential area were shared publicly and even discussed in court. The community did not forgive and the airport has been in court with respect to noise complaints several times during the previous years.

The design of options.

There was no choice for another comparable approach due to requirements within the environmental permit and technical limitations. However, the project is still ongoing, and a final selection of the intervention has not been made yet.

The selection of the intervention.

Originally, the operational priority was to use the curved approach at Stockholm Arlanda Airport. The technical requirements for a curved approach could not be fulfilled in the way that Stockholm Arlanda Airport initially intended. An alternative project approach that would be in line with Arlanda's environmental permit was designed. The idea was to reduce the noise levels by having the aircraft fly at a higher altitude for a longer time. The motivation to apply the Virtual Community Noise Simulator (VCNS) was to provide the opportunity to personally experience differences between operational procedures. The effect of a steeper glide slope angle was investigated, and the operational changes were a part of the airport's environmental permit.

Implementation

During a kick-off meeting, the representatives of the neighbourhood were informed about the different glide slope angles. Parameters of the setup were explained and discussed. A joint decision was made on the selection of the location and the flight procedure [5]. The chosen measurement location is shown in Figure 4.

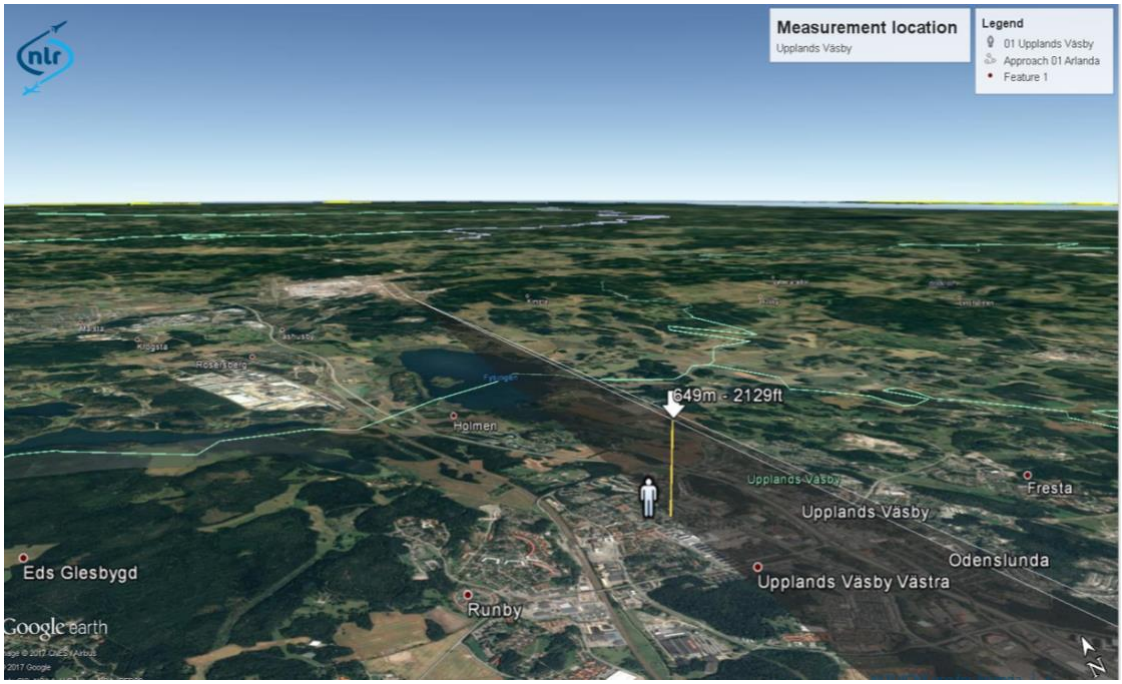

Figure 4: Selected location for VCSN scenario

Video and audio recordings of the surrounding environment and live aircraft movements at the residential area were made and used as baseline for the VCNS scenario. The aircraft noise for the steeper arrival approach at 3,2 degrees angle was modelled. The most common aircraft type was chosen for the simulation. The modelled results were verified with the measured sound levels. A 360-degree video with the desired aircraft procedure was created for a 3,0 degrees inclination approach and a 3,2 degrees inclination approach. Local measurements were carried out to collect video data of the surrounding environment and the aircraft movement at four locations (see Figure 5). Acoustic measurements of the surrounding sound environment including cars, schoolyard, bird etc. were carried out too.

Figure 5: Setup for 360-degree video recordings of the environment and the aircraft movements

A VCNS scenario for residential area close to the airport was implemented to test the expected sound and appearance of an aircraft arriving at Stockholm Arlanda Airport. The goal was to investigate whether the community can hear the difference of rising at a steeper angle – 3,0 degrees versus 3,2 degrees angle applied at around 900 m. The results and the VCSN scenario were presented to a group of representatives of the residential area around Stockholm Arlanda Airport during a gathering and afterwards during a public community meeting (see

Figure 6).

Figure 6: VCSN demonstration during public community meeting

Post-Implementation evaluation.

A questionnaire was used at the workshop to collect the information about the perceived differences of the VCNS scenario. The subjective input from every participating community member was noted and systematic questions were asked. Many people could actually hear differences between the different approach angles which indicated that the VCNS scenarios could capture the change. The large number of participants indicated the public interest in participation and engagement.

The metrics used within this case study are modelling, acoustic measurements, video recordings, workshops and meetings for community engagement. The VCNS scenario included audio recordings of locally measured aircraft noise [6]. Tested flight procedures used the glide angle approach with 3,0 degrees and 3,2 degrees inclination. The measured noise levels were used to verify the calculated noise levels from models.

Conclusions

The goal of applying the VCNS for the community around Stockholm Arlanda Airport was meant to improve the public opinion about the airport. Swedavia, which is the umbrella organisation of Swedish Airports, aimed to reduce the levels of air traffic noise or to keep them within an acceptable range. During a workshop for the residents living around the airport, the VCNS was applied to test whether people can perceive changes in the glide approach angle. It is difficult to say whether the case study was successful – not only the subjective perception but also the distrust of the residents played a role. As the difference was very small, the 3 degree change was not implemented, although the residents appreciated community engagement and virtual simulations.

This case study reflects the importance of engaging with the community in the processes of decision making instead of presenting decisions once they are made. Any change of a flight path or procedure will often not make the noise disappear but move it to another area. It is important that the people understand why a certain change has to happen and what the consequences and motivations were.

References:

1. Swedavia Airports - Statistics (2016), www.Svedavia.se;
2. ESSA – Stockholm Arlanda (2015), www.lfv.se;
3. Stockholm Arlanda Airport extranet, Airport Regulations (2017), https://www.swedavia.net/en/arlanda/airport-Regulations/
4. Swedavia Airports (2016), Neighbour relations at Stockholm Arlanda Airport, ANNA Conference
5. Wennberg, L., Veerbeek, H. (2018). Application of the Virtual Community Noise Simulator (VCNS) around Stockholm.
6. Åsa Göransson, Neighbour relations at Stockholm Arlanda Airport, ANNA Conference, 2016-09-28/29