Continuous Descent Operations (CDOs)

Contents

Introduction 2

What is CDO? 3

Role of regional airports in North Sea Region 4

Benefits CDO 5

Implementation of CDO at regional airports: case study GAE 7

The effects of aircraft noise and atmospheric emissions can cause constraints at aerodromes and increase operational costs. The implementation of Continuous Descent Operations (CDO) at airfields is acknowledged as being one method that helps mitigate these problems. Consequently, implementation of harmonized, capacity-friendly versions of the CDO technique can be beneficial to all European ATM system stakeholders and is in demand by aircraft operators.

-EUROCONTROL-
Introduction

The CDA is now implemented at Groningen Airport Eelde. Recently the term Continuous Descent Approach is renamed to Continuous Descent Operations (CDOs). The effects of aircraft noise and atmospheric emissions can cause constraints at aerodromes and increase operational costs. To help mitigate these issues, CDO offers a flexible continuous descent and approach flight path that delivers major environmental and economic benefits without any adverse effect on safety. Consequently, the rapid, widespread deployment of harmonized, capacity/friendly versions of the CDO technique throughout Europe, even on a limited basis (that is, limited by hours of operation and commencement height), will be beneficial to all European ATM system stakeholders and will empower the network to respond positively to environmental challenges.

The European CDO implementation programme is an industry-wide collaborative effort that has the backing of all stakeholders in European ATM to achieve the requirements laid out in the European Joint Industry CDA Action Plan, launched in 2009, which sets out specific actions for the European Aviation industry to ensure rapid deployment of CDO throughout Europe. At the request of stakeholders, EUROCONTROL is supporting the programme through a dedicated team. Regional airports have until now not shown a high interest in participating in this programme. It takes costs for the airport, with none direct return of investments. EUROCONTROL is developing a support programme for introducing CDO at regional airports. They are visiting regional airports in order to promote this activity. The positive results of CDO on Groningen Airport Eelde (GAE) gives EUROCONTROL a good backup: they can prove that airliners indeed train immediately their pilots on CDO. Therefore it is a good selling point for the airports. Also regions more and more ask the reduction of CO2 on the airport as an condition for growth. The process description of GAE and the positive results will encourage other airports to implement CDO. For example also Airport Eindhoven has started now a study on the possibilities of CDO in Eindhoven. The developing of an NSR description on introducing CDO at airports will contribute to the European Programme. The GSA partners were informed on the progress and will be involved in optimizing a more general NSR description. As the contracts on the CDO at GAE were already in place and working, only the costs of dissemination and the transnational work will be part of GSA.

In this report we will describe what CDO is, what role regional airports in the North Sea Region can play and what the benefits of implementing CDO are in terms of noise reduction, fuel saving and reduction of CO2 emissions.
What is Continuously Descent Operation (CDO)?

A CDO (or previously called CDA) is an aircraft operating technique in which an arriving aircraft descends from an optimal position with minimum thrust and avoids level flight. It is designed to reduce fuel consumption and noise compared with a conventional approach. Instead of approaching an airport in a stair-step fashion, CDO allows for a smooth, constant-angle descent to landing. This reduces noise pollution and saves fuel. Depending on local circumstances, the effects of aircraft noise and atmospheric emissions can impact on the quality of life of communities close to an aerodrome. Fuel is also a major airline cost element. CDO therefore offers environmental and economic advantages.

All stakeholders benefit

Groningen Airport Eelde (GAE) is the first regional airport in the Netherlands offering CDO to incoming aircraft. Due to the unique traffic composition at the airport all stakeholders can benefit. CDO can be used not only by the three aviation academies located at the airport to train pilots but also by incoming chartered and scheduled flights. At the same time air traffic controllers at Groningen Airport Eelde are being trained by Air Traffic Control the Netherlands (LVNL). By offering CDO at Groningen Airport Eelde the newly trained air traffic controllers can incorporate CDO into their training programme.

Supply chain cooperation

In order to realize the successful implementation of Continuous Descent Operations at Groningen Airport Eelde, close collaboration is necessary with all parties involved. Therefore, we are very pleased that further development takes place with our partners at Air Traffic Control the Netherlands, the National Aerospace Laboratory and transavia.com and in continually close collaboration with EUROCONTROL.
Role of regional airports in North Sea Region

Regional airports play a significant role in shaping the economic, social and political landscape of local communities they serve. Today, airport stakeholders are facing increasing economic pressure while public expectations are steadily growing. Rising concerns on climate change increase public awareness of overall airport operations, but also clear communication and corporate responsibility are becoming more important.

A detailed study on the ‘Function and Role of Regional Airports’ was conducted by Prof. Dr. Ulrich Desel from Desel Consulting in cooperation with Ralf Schikorr from MP2 Consulting on behalf of the GSA project. The study results show that the GSA airports have a significant contribution to the economic welfare of the North Sea Region. Considered airports generate total gross value added of more than 2 billion Euros, and a total of 33,000 direct and indirect jobs related to the operation of the GSA airports.

Considering this significant role regional airports play in the local communities they serve, Continuous Descent Operations can contribute in greening airport operations, not only by its direct economical and environmental advantages such as fuel saving and CO2 reduction, but also in public acceptance of the airport by showcasing that the airport is doing its utmost to reduce airport related noise.

Green Sustainable Airports (GSA) is the EU-funded INTERREG project which brings together airport operators and regional authorities from the North Sea Region (NSR) to collaborate on solutions for sustainable airport operations and marketing. The major goal of the project is to improve regional airport accessibility, public communication and acceptance. Lessons learned from implementing CDOs at Groningen Airport Eelde show that, when communicated in a clear and transparent way, implementation of CDO can be beneficial to all stakeholders and help airports to demonstrate good corporate responsibility.
The aviation industry is under great pressure to reduce its impact on climate change. The target has been set by the EU: CO2 emissions from air transport are to be halved by 2020.

With the introduction of Continuous Descent Operations a small but important step has been made towards more fuel efficient aviation with lower CO2 emissions and less noise pollution for people living near flight paths (typically 8 – 25 Nautical Miles). Therefore the three main reasons for implementing CDO are:

- Noise reduction
- Reduction of CO2 emissions
- Save fuel consumption

**Noise reduction**

Groningen Airport Eelde has requested the Netherlands Aerospace Laboratory (NLR) to measure the noise reduction effects of implementing CDO at and around the airport. From the results of the study it becomes clear that the noise reduction is quite significant. A 737 that uses CDO has a 40% smaller noise contour footprint (maximum noise levels are 6-10 dB(A) lower than for a stepped approach).

These figures can be extrapolated for a one-year period. Based on a fleet mix having 1200 arrivals per year a noise reduction of Lden of 5-7 dB(A) underneath the flight path can be found at the larger distances (20-40 km). Close to the airport (within 13 km) the Lden noise exposure is not influenced by the use of CDO.

In the same study, in addition to the noise reduction effects, NLR investigated the fuel savings and emission reductions of implementing CDO at Groningen Airport Eelde.
Save fuel consumption

NLR calculated fuel savings for 2 typical aircraft that make use of GAE, a Boeing 737-800 and Embraer 135/145. The flight distance that an aircraft can fly with the engine running idle to approach the airport is different per aircraft. For a small aircraft this can be several kilometers up to more than 25 km. The fuel saving per arrival for a Boeing 737-800 was calculated at 15 kg, for an Embraer 135/145 this is 2 kg. With an average total amount of 1200 arrivals per year for these 2 aircraft types at GAE already 10 tons of fuel can be saved.

Reduction of CO2 emissions

In general burning 1 kilo of jet fuel creates 3.2 kilo CO2. Based on the research done by NLR it was calculated that 46 kg CO2 per arrival of a Boeing 737-800 would be saved and 5 kg CO2 per arrival of an Embraer 135/145. On an average of 1200 arrivals per year the CO2 reduction is 32 tons.
Implementation of CDO at regional airports: Case study GAE

Background

By the end of 2009 Groningen Airport Eelde (GAE) decided to incorporate sustainability in its strategy for further development of the airport and future growth. Public opinion plays an important role in open communication about corporate social responsibility and sustainability. Organizations are requested to take action to reduce their use of energy and resources and to lower their emissions/carbon footprint.

Besides incorporating sustainability in its corporate strategy and executing it accordingly, GAE wanted to go one step further. Together with the Province Drenthe (regional government) the project Green Sustainable Airports was started in 2010. In this project partners, airports, governments and knowledge institutions in the North Sea Region work together on sustainability. Topics within this project are greening airport operations, sustainable landside accessibility and green marketing.

In preparing for this project several topics were discussed that could contribute to greening airport operations at GAE. The option to go for Continuous Descent Operations (CDO) at GAE quickly came to mind. A known technology and procedure already for some years at large international airports like Amsterdam Schiphol Airport, but not yet executed elsewhere in The Netherlands.

Feasibility and partner interest

Also within Europe CDO was hardly used or implemented at airports although its advantages are obvious. After a simple feasibility study was done by searching the internet for possibilities, applications, advantages- and disadvantages it appeared that airline companies were very positive due to possible fuel savings.

Reduction of fuel consumption is an important issue by airline companies. They try a.o. to reduce the weight of the aircraft by not taking any unnecessary items or luggage on board to prevent that unnecessary fuel is being burned. Next to this it appeared that the implementation of CDO in Europe was one of the key political priorities and countries had committed themselves to it, but for no apparent reason execution had failed so far.

GAE contacted the Dutch Air Traffic Control ‘Luchtverkeersleiding Nederland(LVNL)’ the organization that is responsible for air traffic control in The Netherlands and plays a decisive role in flight routes as well as CDO.
LVNL was enthusiastic to work together with GAE to implement CDO. Air Traffic Control is responsible for route development but airports have to decide about its operational use. The use of CDO could lower the capacity of airports.

This is due to the fact that once an aircraft has started its Continuous Decent Approach (CDA) towards the airport, no flight changes are allowed as interfering in the flight path with engines running in idle modus would abort the environmental advantages.

Conditions

In order to benefit from CDO more airspace is required and a larger distance has to be obtained towards other aircraft. Airports can decide that CDO will not be allowed at certain times but e.g. only after peak hours or at night. If CDO affects the airports capacity will depend on many factors like the layout of the airport (ILS, total amount of runways ETC), flight routes, the total amount of incoming and outgoing aircraft and their spread in timing. In general, with only a few CDAs per hour airport capacity will not reduce significantly. In the near future it is expected that, due to new technologies and European programs such as Single European Sky, CDAs will not lead to further reduction of airport capacity. Aircraft will have more communication possibilities to interact with each other. This will allow for shorter distances in between aircraft, both horizontally as well as vertically. The Nationaal Lucht en Ruimtevaart Laboratorium (Dutch Aerospace Laboratory) will perform a second series of tests in 2014 at Groningen Airport Eelde to test and develop these new technologies.

Other organizations are also capable of developing CDO and new flight routes. But close collaboration with the national air traffic control is mandatory. Given the fact that CDO at regional airports was new in The Netherlands, GAE decided to develop this with Dutch Air Traffic Control (LVNL).

Route development

LVNL has developed the flight routes. Important in this is to define how much airspace is available to descent aircraft from high altitudes. Typically this is around 30.000 feet, approximately 11 km. For The Netherlands, being a small country, this means that aircraft can already start with their CDO outside The Netherlands. As a small country but with intensive use of airspace, outgoing and incoming aircraft from other airports like Amsterdam Schiphol Airport will affect the possible use of CDO. For GAE most of the air traffic is coming from the south and flight routes are crossing with Schiphol air traffic. In this situation it is more complicated to guarantee enough airspace separation between aircraft as incoming aircraft with CDO cannot be given another flight route or altitude. That would not be desirable and could introduce risks that cannot be mitigated with last minute interference.

In case of GAE a suitable location was found where these complicating effects would not occur. From this location (near Drachten) a suitable flight approach was developed in 3D. Not only in the air but also on the ground, the challenge is to avoid as much as possible that aircraft fly over cities or villages. This makes it a complex process to execute by Air Traffic Control. In route calculations many things have to be taken into account like flight routes, airspace structure and legal conditions.
Implementation of CDO at GAE

Once this was ready, operational execution of the CDO was discussed and evaluated with Transavia. To put it simple, the question was if it would be easy to fly and execute by the pilot. This was done in a flight simulator and the results were positive. Then the data were further optimized to get optimal results. Worth mentioning here is that, in doing this, the flight route could be moved north along the city of Groningen and thus reducing impact on a large amount of city residents.

This doesn’t mean that there are any (additional) negative consequences due to CDO for those individuals on the ground that do live within this flight route. By using CDO the noise levels on the ground are reduced with circa 5dB, which means a noise reduction of circa 50%.

After a safety assessment procedure by Air Traffic Control formal approval was given by the responsible authorities and implementation of CDO at GAE could start. Important aspect here is to start clear and targeted communication to all stakeholders about the flight route, the (environmental) advantages and emphasizing the optimal use of CDO. Weather conditions like wind direction, the actual use of, or other activity on the runway, all play a role if CDO can be used. In the end it is the pilot together with Air Traffic Control who decide what flight route and runway approach to use. In its first year already 60% of all commercial flights at GAE made use of CDO. It is GAEs wish to grow this further to 80%.

Results

Implementing CDO at GAE has brought significant environmental advantages. Flight routes have been optimized to avoid unnecessary noise nuisance for residents in and around the flight route. In addition a noise reduction of 5dB due to aircraft engines running idle is perceived as a noise reduction of 50% on the ground. Jet fuel is saved compared to traditional aircraft landing procedures. This leads to reduced emissions and cost savings for airline companies.

Implementation of CDO will be different for each airport. But if conditions are met CDO could be implemented at all regional airports and offer significant environmental benefits.
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