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POSSIBILITIES OF USING THE APPROACH WITH CONTINUOUS DESCENT APPROACH PROCEDURES AT THE AIRPORT KOŠICE

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The final thesis is oriented on approach procedures to the airport with CDA technique, a technique steady descent. It describes the general characteristics, definitions, methods and design CDA states to the issue, which is associated with the procedure. Then there are defined basic conditions, advantages and objectives to consider when establishing procedures to pay attention to traffic.

It is divided into four chapters. The first chapter defines what the aim of the thesis is and defines the methodology in the development work. The second focuses on the theoretical basis zoom Continuous Descent Approach Procedure. The second chapter focuses on the description of the Global Navigation Satellite System GNSS. Finally, the third chapter describes the possible proposal CDA approach procedure to Kosice airport.

Keywords: Continuous descent approach, Global Navigation Satellite System, arrival route, CDO ICAO manual 9931, approach

1. INTRODUCTION

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

2. CONTINUOUS DESCENT APPROACH

In ICAO Document 9931, the ‘Continuous Descent Operations Manual’, CDO is defined as “an aircraft operating technique aided by appropriate airspace and procedure design and appropriate ATC clearances enabling the execution of a flight profile optimized to the operating capability of the aircraft, with low engine thrust settings and, where possible, a low drag configuration, thereby reducing fuel burn and emissions during descent. The optimum vertical profile takes the form of a continuously descending path, with a minimum of level flight segments only as needed to decelerate and configure the aircraft or to establish on a landing guidance system (e.g. ILS).”

The optimum vertical path angle will vary depending on the type of aircraft, its actual weight, the wind, air temperature, atmospheric pressure, icing conditions, and other dynamic considerations. A CDO can be flown with or without the support of a computer-generated vertical flight path (i.e. the vertical navigation (VNAV) function of the flight management system (FMS)), and with or without a fixed lateral path. However, the maximum benefit for an individual flight is achieved by keeping the aircraft as high as possible until it reaches the optimum descent point. This is most readily determined by the onboard FMS.

1.1. CDO DESIGN OPTION

There are currently two methods for the design of CDO procedures based on „laterally fixed" routes. These result in the need for different methods to assist in providing the flight distance to the runway threshold. These two design methodologies are identified as respectively ―closed path and open path designs.

The closed path design is a design where the route is fixed and the specific distance to the runway is known prior to start of the continuous descent operation. The procedure may be published with crossing levels, level windows and/or speed constraints. The design of the closed path may comprise the STAR and (initial) approach phases of flight until the FAF/FAP final approach point (FAP).

The open path design is a design where a portion, or all, of the route consists of vectoring. The specific distance to runway threshold is not known prior to start of the CDO.

Vectored CDO procedure

- The aircraft is vectored and the pilot is given an estimate of distance-to-go to the runway threshold. Clearance to commence descent is at the discretion of the pilot.

Open CDO procedure to downwind

- Operation based on a combination of a fixed route delivering aircraft to a vectoring segment, normally as an extension of the downwind leg to the FAF/FAP.

1.2. BENEFITS

CDO offer the following advantages:

a) more efficient use of airspace and arrival route placement;
b) more consistent flight paths and stabilized approach paths;
c) reduction in both pilot and controller workload;
d) reduction in the number of required radio transmissions;
e) cost savings and environmental benefits through reduced fuel burn;
f) reducing the incidence of controlled flight into terrain (CFIT);
g) operations authorized where noise limitations would result in operations being curtailed or restricted.

1.3. CDA vs. Non CDA

In a conventional, non-CDA, approach the aircraft descends stepwise, with portions of level flight in-between. By performing a CDA the aircraft remains higher for longer and operates at lower engine thrust. Both of these elements induce a reduction in fuel use, emissions and noise along the descent profile prior to the point at which the aircraft is established on the final approach path.

The ideal CDA starts at the top of descent and ends when the aircraft starts the final approach and follows the glide slope to the runway. Typically CDAs are not possible all the time, not for all arriving flights and not always for the whole descent profile. But at more and more airports measures are taken to use CDA to the extent possible and to gradually increase the percentage of CDA-flights.

1.4. JOINT INDUSTRY CDA ACTION PLAN – PRICIPLES

In progressing this joint industry CDA Action Plan we will adhere to the following principles:

- Safety remains paramount.
- CDA should be implemented to the extent possible, but not so as to adversely effect Military airspace usage, Civil/Military airports or airspace capacity in general.
- Without prejudice to safety, the fuel and environmental benefits of CDA shall be optimized.
- There is only one CDA as defined in EUROCONTROL and ICAO guidance - but there are various ways to facilitate it.

- CDA can be implemented from any altitude but where and when possible the aim should be an optimized descent profile from top-of-descent.
- The decision on CDA implementation and facilitation methods shall be local, but within the EUROCONTROL / ICAO harmonized framework.
- CDA may not always be possible for all terminal airspaces / aerodromes and this should be recognized.
- CDA should be considered in the context of the entire terminal airspace, other operations and the ATM system itself.
- The implementation of CDA should not trigger unacceptable trade-offs in other operations (e.g. for non-CDA arrivals or for departures).
- Successful CDA implementation requires collaboration between local operational stakeholders. EUROCONTROL Collaborative Environmental Management guidance3 is available, if required, to support this process.
- CDA is the 'art of the possible' with initial efforts forming the foundations for more advanced techniques in the future – CDA is possible now using existing airport and aircraft infrastructure. We should not wait for the perfect solution.
- At altitudes where noise is no longer the dominant impact, fuel efficiency and emission reductions shall be given priority.
- Future technologies and procedures, as delivered through the SESAR ATM Master Plan, will provide more advanced facilitation of CDA. Whilst acting now, we should therefore plan for these developments.
- Public expectations should not be raised unnecessarily.
- Good practice should be captured and promulgated.

1.5. CDA REQUIEREMENTS

As local conditions require, CDA may comprise any of the following:

- Standard Arrival Routes (STARs) (including transitions) which may be designed with vertical profiles. The routes may be tailored to avoid noise-sensitive areas as well as including the vertical profile (see ICAO PANS-OPS Doc 8168, Volume II) and the provision of Distance To Go (DTG) information.
- The provision of 'distance from touchdown' (hereinafter referred to in this document as 'distance to go' (DTG)) information by Air Traffic Control during vectoring.
- Combination of these: STARs being used in low traffic density, and DTG estimates being issued by ATC as and when radar intervention is required e.g., during busy periods.

Key CDA Elements Include:

- Providing accurate and timely DTG information to pilots in order to achieve CDA.
- Avoiding giving descent clearance prior to the point at which a CDA would naturally occur and giving an estimated distance from touchdown to the pilot to allow the aircraft to intercept the approach glide path with a minimum of level flight.
- Provision of appropriate speed requirements to facilitate a continuous descent profile without the need for segments of level flight.
- Avoiding unnecessarily early deployment of flap and undercarriage where this does not conflict with the safety requirements and company operating procedures.
- Incorporating Low-Power/ Low- Drag techniques to the extent possible.

2. GLOBAL NAVIGATION SATELITTE SYSTEMS

2.1. GPS

The Global Positioning System (GPS) is a space-based satellite navigation system that provides location and time information in all weather conditions, anywhere on or near the earth where there is an unobstructed line of sight to four or more GPS satellites.[1] The system provides critical capabilities to military, civil, and commercial users around the world. The United States government created the system, maintains it, and makes it freely accessible to anyone with a GPS receiver.

2.2. GLONASS

GLONASS is a space-based global navigation satellite system (GNSS) that provides reliable positioning, navigation, and timing services to users on a continuous worldwide basis freely available to all. GLONASS receivers compute their position in the GLONASS Reference System using satellite technology and based on triangulation principles. It is an alternative and complementary to other GNSS systems such as the United States' Global Positioning System (GPS), the Chinese BeiDou navigation system or the planned Galileo positioning system of the European Union (EU).

2.3. COMPAS /BEIDOU

The BeiDou Navigation Satellite System is a Chinese satellite navigation system. It consists of two separate satellite constellations – a limited test system that has been operating since 2000, and a full-scale global navigation system that is currently under construction.

2.4. GBAS

Augmentation of a global navigation satellite system (GNSS) is a method of improving – “augmenting”– the navigation system's performances, such as integrity, continuity, accuracy or availability thanks to the use of external information to the GNSS into the user position solution.

A Ground-Based Augmentation System (GBAS) is a civil-aviation safety-critical system that supports local augmentation –at airport level– of the primary GNSS constellation(s) by providing enhanced levels of service that support all phases of approach, landing, departure and surface operations. While the main goal of GBAS is to provide integrity assurance, it also increases the accuracy with position errors below 1 m (1 sigma).

2.5. SBAS

A satellite-based augmentation system (SBAS) is a system that supports wide-area or regional augmentation through the use of additional satellite-broadcast messages. Such systems are commonly composed of multiple ground stations, located at accurately-surveyed points. The ground stations take measurements of one or more of the GNSS satellites, the satellite signals, or other environmental factors which may impact the signal received by the users. Using these measurements, information messages are created and sent to one or more satellites for broadcast to the end users. SBAS is sometimes synonymous with WADGPS, wide-area DGPS.

2.6. EGNOSS

EGNOS (European Geostationary Navigation Overlay Service) is the European satellite-based augmentation service (SBAS) that complements the existing satellite navigation services provided by the US Global Positioning System (GPS). EGNOS provides the first European GNSS services to users. EGNOS constitutes together with Galileo the two major initiatives in Europe in terms of satellite navigation.

3. CONCLUSION

Continuous descent approach is currently very hot topic. CDA certainly has their future and irreplaceable for increasing efficiency, friendly and economical reduce the impact of air traffic on the environment in the phase of flight approach to the airport .

Continuous Descent Approach (CDA) offers an early opportunity to save over 150,000 tonnes/year of fuel worth around 100 million Euro per annum1 in ECAC, whilst at the same time reducing CO2 emissions by almost 500,000 tonnes per annum and reducing noise impact on the ground by around 1-5 dB per flight. CDA is a priority requirement of the SESAR Master plan for the IP1 timeframe to be widespread practice before the end of 2013.

Maximum benefit from CDA is achieved when arriving aircraft closely follow an optimum continuous descent profile, whilst simultaneously minimising thrust, avoiding sudden changes in thrust and reducing airframe noise by maintaining a clean aircraft configuration for as long as possible. The nature and extent of the benefit from CDA will vary depending on the local situation but would typically include a significant noise, fuel and emissions reduction along the descent profile prior to the point at which the aircraft is established on the final approach path.

4. LITERATURE LIST

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