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"BUSINESS CASE" ACTIVITIES IN AVIATION. EVIDENCE FROM RESEARCH AT KATOWICE AIRPORT

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ABSTRACT

During performing researches as part of the European programs associated with the implementation of new techniques and the technology in aviation, it turned out that it is necessary to prepare a "Business Case" document. During the completion of three international projects, as part of workshops, there were accepted certain theoretical models of drawing these documents up. There was a need to prepare the appropriate model solution for every country. The article is presenting such model as well as method of business analysis which should be applied in the air transport during the implementation of new techniques and the technology. The algorithm of execution of the "BUSINESS CASE" was presented in the following sections of the material – its validation took place during the international project SHERPA (Support ad-Hoc Eastern Region Pre-operational Actions in the GNSS).

KEYWORDS BUSINESS CASE, GNSS, SHERPA, air transport, airport

INTRODUCTION

Katowice is a city located within the Silesian metropolitan area in the South of Poland. This region had one of the highest scores in joint population density in Poland, with 180 persons per square kilometer and the total population of the Silesian metropolitan area being approximately 4.7 million. Such great potential plays an important role in air transport which stimulates regional employment and economic growth. The central point of air transport system in Silesian metropolitan area is Katowice Airport (EPKT) – one of the largest regional airports in Poland, the largest airport in Silesia and one of the most dynamically developing Polish airports. In 2015 EPTK/Katowice Airport handled 3,069,279 passengers (2,695,732 in 2014, 13% growth), 31,727 air operations (28,771 in 2014) and 16,119 tons of cargo (16,269 in 2014). Moreover, EPKT took over a part of air traffic and passenger traffic due to World Youth Days in Kraków.

In order to strengthen its capacity and business activities, there was made a model study of Business Case for implementation of special aviation procedures. These documents are a specific tool supporting planning and decision-making at aerodromes and airports, especially assisting decisions related to capital investment, products or services development, investments and products (Operational…, 2007; Standard…, 2013). A business case was conducted at Katowice Airport according to (Guidance…, 2012; Guidance…, 2013) and based on standards and recommended practices of ICAO (RNAV…, 2009) and EUROCONTROL (Standard…, 2013). More specifically, in the following sections is presented business case for implementation of a LPV (Localizer Performance with Vertical Guidance) approach – the kind of Required Navigation Performance Approach (RNP APCH) (ICAO…, 2012).

SCENARIO CHARACTERISTICS FOR KATOWICE AIRPORT

The business case activities take into account whether an ILS is available or not at the examined runway (RWY 09) of airport and whether it has an impact on financial results. The main characteristics of Katowice Airport (EPKT) are presented in table 1 and were defined in SHERPA report (Fellner, 2013) as well as in AIP Poland (Aeronautical…).

Table 1. Basic Katowice Airport data

Name	Katowice Airport
ICAO code	EPKT
IATA code	KTW
Numbers of runaways	RWY 09 RWY 27 RWY 27D
Threshold where to implement LPV	RWY 09
WGS-84 coordinates	50°28’27”N; 019°04’48”E
ILS equipped on examined RWY 09?	No
Elevation	1007 ft.
Reference temperature	25°C
Types of traffic permitted	IFR/YFR

Source: Fellner, 2013.

COSTS OF IMPLEMENTATION PROCEDURE

Typical costs related to the implementation of a LPV (Localizer Performance with Vertical Guidance) approach procedure can be broken down into aspects depicted in the table below. Costs related to RWY physical characteristics maybe included as required by the scenario: lightning systems, airfield works, obstacles removal, etc. These can be very different per scenario. In the case of publishing the LPV as an ILS back-up no costs are foreseen (Fellner, 2013). Details are presented in table 2.

Table 2. Scenario of implementation costs

Activity	Cost [KEUR]
LPV procedure design	19,200
Safety Study	4,800
Obstacles survey	13,200
Approval by authority	2,400
Testing (Flight Check)	19,180
Publication	1,200
Other/s (specify and add new rows)	–

Source: Fellner, 2013.

AIRPORT'S OPERATING FEES

In order to simplify the calculation of benefits derived from the increased number of completed landings thanks to the implementation of LPV operations, the following is applied: landing fee based on aircraft maximum take-off weight (MTOW), parking fee only applies if parking lasts for more than 4 hours (Fellner, 2013). Mentioned fees are shown in table 3.

Table 3. Flat rates assumed per aircraft category

	CAT A	CAT B	CAT C	CAT D
MTOW (tons)	1	6	78	220
Landing fee (€)[1]	50	60	780	2,200
Parking time (h)[2]	>4	>4	>4	>4
Parking fee (€)	6	12	156	440

[1] These are estimated values of charges in euro because all charges set forward in the tariff are expressed in Polish zlotys (PLN).

[2] Charges are not levied for aircraft parking for up to 4 hours.

Source: Fellner, 2013.

REVIEW OF TOTAL AIRCRAFT LANDINGS

Following the model described in above paragraphs, the first task is to collect statistics on the total number of landings at the airport. Traffic forecasts have been also established for the near-midterm period. It is important to note that the next table presents only landings' statistics (not total number of operations, which would include departures). Next step is to establish how many of the above operations are conducted towards the thresholds where LPVs are to be implemented. Runway in use (airport configuration) typically depends on the prevailing wind direction at the airport, as aircraft shall take-off and land against the wind (Fellner, 2013). Details are presented in tables 4 and 5.

Table 4. Total number of airport landings

Year	PAX landing ops	Change (%)	Cargo landing ops	Change (%)
2007	10,829	–	1,415	–
2008	12,058	11.35	1,457	2.97
2009	11,960	–0.81	1,143	–21.55
2010	12,182	1.86	1,203	5.25
2011	13,250	8.77	1,380	14.71
2012	13,937	5.18	1,355	–1.81
2013	14,840	6.48	1,590	17.34
2014	15,963	7.57	1,832	15.22
2015	17,405	9.03	2,037	11.19
2016	18,394	5.68	3,775	85.32
2017	19,322	5.05	4,454	17.99
2018	20,201	4.55	4,839	8.64
2019	20,680	2.37	5,127	5.95

Source: Fellner, 2013.

Table 5. Runaway configuration of EPKT airport

Runaway configurations (%)	
THR 09 configuration	5
THR 27 configuration	95

Source: Fellner, 2013.

By applying RWY usage percentages to the total number of landings, it will be possible to estimate the number of landings performed to the thresholds where LPV is to be implemented. This is presented in table 6 (Fellner, 2013). As no ILS procedures are published at runway/s where LPV is to be implemented, the figures in table 6 can be directly used for subsequent steps of the study.

Table 6. Total number of landings at LPV runaways

Total number of landings at LPV runways		
Year	PAX ops	Cargo ops
2013	742	80
2014	798	92
2015	870	102
2016	920	189
2017	966	223
2018	1,010	242
2019	1,034	256
2020	1,034	271

Source: Fellner, 2013.

DISRUPTION PROBABILITY PER APPROACH TYPE

The disruption probability per approach type is calculated based upon a combination of the approach OCH (Obstacle Clearance Height) and meteorological conditions at the time of approach. The main idea is that if the (M)DA/(M)DH of an approach is greater than the recorded cloud ceiling or the recorded visibility exceeds the required level, then a disruption will ensue. To conduct such analysis it is necessary to know the lowest MDH (Minimum Descent Height) provided by conventional navigation means at the implementation RWY – see table 7.

Table 7. MDH per aircraft category at RWY 09

MDH (ft)					
RWY	NAVAID	CAT A	CAT B	CAT C	CAT D
09	VOR	427	443	476	509

Source: Fellner, 2013.

For the further analysis, meteorological data were collected from the Aeronautical Meteorological Station Katowice – Pyrzowice Airport from period 01.01.2012–31.12.2013 (Fellner, 2013). With this data, a disruption probability per a/c category was calculated, and the results are presented in the following table.

Table 8. Disruption probability for NPA landings

Disruption probability for NPA landings (%)				
	CAT A	CAT B	CAT C	CAT D
Disruption due to cloud ceiling	10.6	11.2	11.8	12.8
Disruption due to visibility	8.4	9.6	10.4	10.9
TOTAL	18.9	20.8	22.2	23.7

Source: Fellner, 2013.

AIRCRAFT NPA DISRUPTIONS

The total number of NPA (Non-Precision Approach) disrupted landings is equal to the product of the number of NPA landings per year multiplied by the probability of disruption for the particular approach type. As shown in tables 9 and 10, the first step is to estimate the percentage of landings executed per aircraft category (Fellner, 2013).

Table 9. Percentage of landings per aircraft category

CAT A	CAT B	CAT C
3.78	14.67	81.27

Source: Fellner, 2013.

Table 10. Number of NPA disrupted landings

Number of NPA disrupted landings								
	CAT A		CAT B		CAT C		CAT D	
Year	PAXops	Cargo ops	PAX ops	Cargo ops	PAX ops	Cargo ops	PAX ops	Cargo ops
2013	5	1	23	2	134	14	0	0
2014	6	1	24	3	144	17	1	0
2015	6	1	27	3	157	18	1	0
2016	7	1	28	6	166	34	1	0
2017	7	2	29	7	175	40	1	0
2018	7	2	31	7	183	44	1	0
2019	7	2	32	8	187	46	1	0
2020	7	2	32	8	187	49	1	0

Source: Fellner, 2013.

REDUCTION IN DISRUPTIONS

To eliminate number of NPA disrupted landings, there shall be flight tests conducted by using the new LPV operation designed for the implementation at RWY's. But before conducting these exercises, assumption on the different LPV navigation capabilities per aircraft categories will need to be established (Fellner, 2013) – it is presented in table 11.

Table 11. Aircraft LPV navigation capability

LPV equipage per category (%)			
CAT A	CAT B	CAT C	CAT D
70	40	20	10

Source: Fellner, 2013.

Next step is to consider the LPV Obstacle Clearance Heights per aircraft category (A, B, C, D) for Required Navigation Performance Approach at RWY 09 – which is shown in table 12.

Table 12. LPV OCH per aircraft category at RWY 09

OCH (ft)					
RWY	RNP APCH	CAT A	CAT B	CAT C	CAT D
09	RNAV	244	256	264	275

Source: Fellner, 2013.

The last step is to calculate the total number of disrupted landings after LPV implementation. This calculation was made for the period 2013–2020. What is more, it took into account passengers operations (PAX ops) as well as cargo operations (Cargo ops). Results are presented in the table below. It is worth noticing that every year the number of LPV disrupted landings peaked during passengers operations for CAT C. The number of LPV disrupted landings is included in table 13.

Table 13. Number of LPV disrupted landings

Year	Number of LPV disrupted landings							
	CAT A		CAT B		CAT C		CAT D	
	PAX ops	Cargo ops	PAX ops	Cargo ops	PAX ops	Cargo ops	PAX ops	Cargo ops
2013	2	0	5	1	13	1	0	0
2014	2	0	5	1	14	2	0	0
2015	3	0	6	1	16	2	0	0
2016	3	1	6	1	16	3	0	0
2017	3	1	6	1	17	4	0	0
2018	3	1	7	2	18	4	0	0
2019	3	1	7	2	18	5	0	0
2020	3	1	7	2	18	5	1	0

Source: Fellner, 2013.

CONCLUSION

Total cost savings are defined with respect to the base case and are calculated by applying a standard cost per disruption. The benefits for the airport will be those generated by the number of landings successfully completed thanks to the superior performances of LPV operations in contrast with NPA operations. To conduct such assessment it is necessary to apply the fees to the landing figures of table 10 and table 13. The following table 14 is filled according to the guidelines above.

Table 14. Benefits derived from LPV implementation [€]

Year	Non-collected fees in conv. environment	Non-collected fees in RNP APCH environment	Benefit derived from LPV implementation
2013	117,240	11,380	105,860
2014	129,750	12,940	116,810
2015	140,850	14,610	126,240
2016	160,640	15,440	145,200
2017	172,510	17,000	155,519
2018	181,990	17,900	164,090
2019	186,790	18,680	168,110
2020	189,130	18,680	170,450

Source: Fellner, 2013.

In summary, the business case for implementation of a LPV approach at EPKT was based on standards and recommended practices of ICAO (Eurocontrol, 2009) as well as EUROCONTROL (Standard…, 2013) as part of a research conducted by SHERPA, which was financed by the EU (Support ad-Hoc Eastern Region Pre-operational Actions in the GNSS). The algorithm of execution of such analysis was presented in the sections above. As follows from the calculation, total benefit derived from LPV implementation over the period 2013–2020 for EPKT amounts to 1,152,270 euros.

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"Business case" w działalności lotniczej. Wyniki badań w katowickim porcie lotniczym

STRESZCZENIE Podczas wykonywania badań w ramach europejskich programów związanych z implementacją nowych technik i technologii w lotnictwie, okazało się niezbędne przygotowanie analizy biznesowej w formie dokumentu „Business Case". W wyniku zrealizowania trzech międzynarodowych projektów oraz walidacji przyjętych założeń podczas zajęć warsztatowych, został zaakceptowany i przyjęty na forum europejskim teoretyczny model sporządzania tego dokumentu. Na tej podstawie konieczne było przygotowanie odpowiedniego rozwiązania modelowego w każdym państwie. W artykule przedstawiono zarys teoretyczny przyjętego modelu jako metody analizy handlowej, która powinna być zastosowana w transporcie lotniczym, podczas wprowadzania nowych technik i technologii. Algorytm wykonania dokumentu „Business Case" został przedstawiony w kolejnych częściach materiału a jego walidacja nastąpiła podczas międzynarodowego projektu SHERPA (Support ad-Hoc Eastern Region Pre-operational Actions w GNSS), w ramach którego implementowano 21 procedur podejścia RNAV GNSS na polskich lotniskach.

SŁOWA KLUCZOWE Business Case, GNSS, SHERPA, air transport, airport

Translated by Andrzej Fellner