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THE IMPACT OF CURRENT DEVELOPMENTS ON THE BAGGAGE FLOW AT AIRPORTS AND DERIVED TRENDS IN AIRPORT LOGISTICS

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ABSTRACT. In the last years civil aviation has developed more and more to a means of mass transportation and is thereby identified with an immense cost pressure. This development becomes apparent by the strong growth of the Low Cost Carrier market segment. The rising market altogether and the special requirements derived from the low-cost segment cause an adjustment of the baggage flow at airports.

Key words: baggage handling, luggage handling, baggage, airport logistics, aviation logistics, baggage dispatch.

INTRODUCTION AND DEPICTION OF NECESSARY OPTIMIZATION IN THE LOGISTIC PROCESS

Traffic in international aviation is constantly increasing during the last years. In Europe it will rise the double within 20 years. Hence it follows that the 8 million flights of 2000 will grow up to 16 million flights per year in 2020 [cp. Eurocontrol 2005]. As a consequence aircrafts like the Airbus A380 will be used more and more for long-distance flights. Parallel a second trend is foreseeable. A research of DLR and ADV points out the immense rising of the Low Cost Carrier market.

The 128 routes, which exist in July 2003, grew up to 426 routes within 3 years.

The rising market altogether and the special requirements derived from the low-cost segment cause an adjustment of the baggage flow at airports particular in security and speed.

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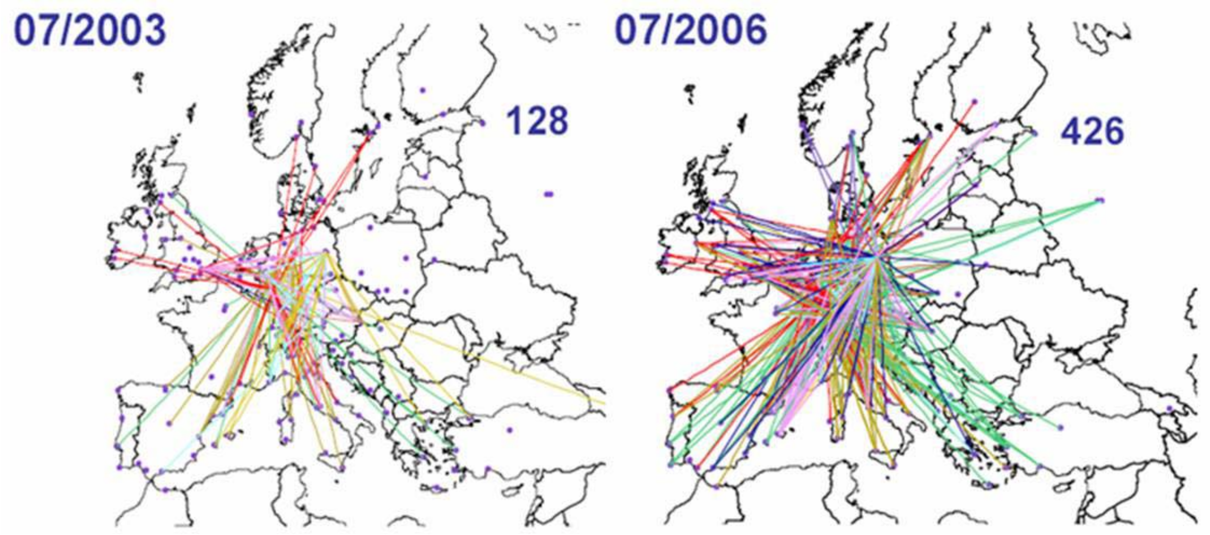

Fig. 1. Expansion of the Low Cost Carrier network [DLR and ADV 2006]
Rys. 1. Ekspansja sieci tanich przewoźników [DLR i ADV 2006]

DESCRIPTION OF BAGGAGE HANDLING IN THE CURRENT PROCESS

On the one hand there are passengers and on the other hand there are baggage flows at the airports. After the passenger passed the check-in the baggage is in charge of the airport. From this point the airport logistic has the task to sort baggage depending on its destination and arrange the cargo for each aircraft. The process has to satisfy high safety requirements. Technical solutions for baggage handling differ from airport to airport. Baggage may be loaded manually at airports with fewer throughputs and with automated means especially at new designed ones with high throughput. The process consists of baggage transport into the make-up room in combination with the security check. Before reaching the make-up room, baggage is sorted after its destination. Employees who work in the make-up room move baggage from conveyors to carts and baggage containers for the transport to the aircraft. Automation of security checks and sortation is already possible and used at some airports for a few years, since there exist well-engineered solutions at the market. In contrast to this the automated turnover from make-up room conveyors to the means of transport is currently developed and tested. The solution developed by Projektlogistik GmbH is called "FEBhand" [Hentschel, Erxleben 2006] and offers an interesting approach for this point.

As explained earlier, either baggage in carts or containers are moved on the apron. Even if loading of containers implicates advantages, since the baggage is bundled, however not all types of aircraft are able to transport containers. Furthermore this type of transaction demands the availability of empty containers at the airport to guarantee a fast exchange. That causes high costs and hence it follows that especially Low Cost Airlines avoid using containers. The earlier explained increasing Low Cost Carrier market at intra Europe flights causes growth in transporting loose baggage.

The disadvantage of transporting loose baggage compared with loading containers is mainly the piece by piece handling. It is split down to single pieces directly in front of the ramp to be moved into the aircraft. Inside the cargo compartment, ramp agents have to move and position baggage.

Fig. 2. Manual turnover of baggage from a baggage cart to a conveyor [Baden-Airpark 2005]
Rys. 2. Ręczny przeładunek bagażu z wózka bagażowego na podajnik [Baden-Airpark 2005]

Figure 2 shows the unloading of baggage carts exemplarily. The weight of some baggage pieces can reach up to 85 lb. Aircrafts are loaded with 100 or 150 pieces of baggage and the physical dimensions of equipment, such as carts, belt loaders, and the cargo compartments, force ramp agents into awkward and hazardous postures when handling baggage. The immense force becomes obvious, when it is compared with the guidelines in most industries. There the weights are strictly limited to 40 lb if that it is handled in optimal postures.

Furthermore conditions can be particularly stressful because of the short turnaround times. Turnaround is defined as the time between the arriving of the aircraft at the dispatch position and leaving it for getting to the runway. During the turnaround an aircraft is simultaneously getting fuelled, cleaned and the baggage is unloaded and loaded. Moreover catering is arranged and new passengers enter the aircraft after the arriving ones left it. Most Low Cost Airlines restrict this time to 20 minutes. One ramp agent moves about 18 tn of baggage per shift, because of the fast sequenced dispatch.

After unloading and loading the aircraft, the arriving containers are transported to the terminal. At first the loose baggage has to be moved into the carts and then it is transported to the terminal. Afterwards a loading agent moves baggage from containers or carts to a conveyor, which transports it inside the terminal. This motion is done in the same awkward and hazardous postures like handling baggage at the aircraft. The passengers take their piece of baggage and leave the airport.

POTENTIALS FOR IMPROVING THE CURRENT PROCESS AND RESULTING REQUIREMENTS FOR NEW BAGGAGE FLOW SOLUTIONS

Obvious problems in the current process of loose baggage handling are the hazardous postures for the agents and long waiting times until the arriving passenger gets its baggage. The following approaches may solve both problems.

The baggage flow process can be redesigned in the way that transition points are reduced or the number of agents is being raised up. Both options are not implementable. The separation of baggage at the aircraft as well as at the terminal can not be avoided. To raise the number of ramp agents in front of the aircraft does not fasten the process, because the agent inside the cargo compartment is the bottleneck. A time advantage would be to raise the number of agents at the terminal, but exposure on the agents would stay high.

The next option is an automated baggage flow, which makes handling more ergonomic and speeds up unloading carts at the terminal.

Identification of solutions implicates different requirements of involved trades and controlling bodies that are displayed in figure 3.

Involved trades are the airport, the ground service providers, the airline and the Luftfahrt-Bundesamt (LBA). Derived technical requirements are ecological, security relevant and result from the process. In addition to the technical fulfillment of requirements, profitability is a condition precedent.

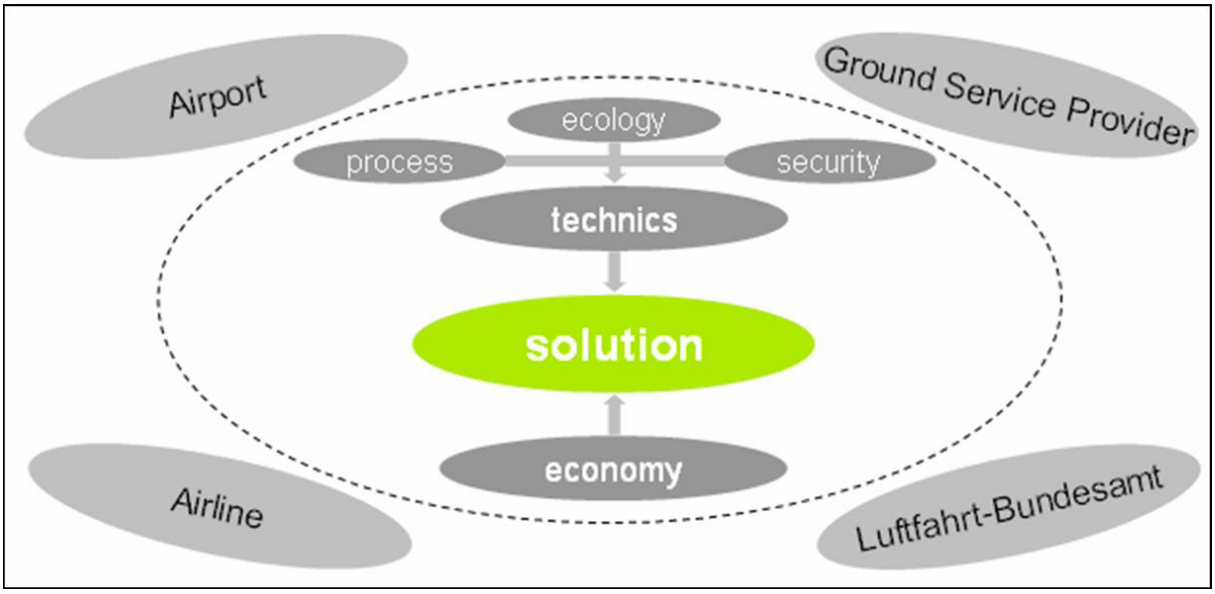

Fig. 3. Requirements for a solution
Rys. 3. Wymagania dla rozwiązania

The most important technical and economical basic conditions are listed below.

Technical requirements

Requirements result from baggage and process interfaces.

Baggage is classified into free allowanced and bulky baggage. Furthermore differences within these categories can be detected. An example for bulky baggage is a small and light umbrella as well as a bulky and large bicycle. Free baggage allowance is defined, but these definitions differ from airline to airline. Volumes from 10 to 250 liter and weights up to 90 lb may occur. A minimum weight is not specified. Surface property and form stability reach from non-slipping and compressible materials like synthetic rubber to metal materials that are absolutely robust and slippy. The load sharing inside the baggage is not identifiable for ramp agents and can cause injuries because of wrong handling.

Defined interfaces of the process are the make-up room, where baggage is moved to the carts or containers, the aircraft and the baggage claim area, where the arriving passenger gets its baggage. Aircrafts differ insignificant. The primary considered Low Cost Airlines usually use aircrafts with a passenger capacity of 100 or 200 and a coherent cargo compartment. The fast turnaround does not make it necessary to supply the aircraft with electric power and hence it follows that the possible solution can not access electric energy. The dispatch area is small and the solution has to share the available space with equipment like the passenger stairway and the catering car. So the required space has to be smaller or stay the same as in the current state. The beltloader, which is used currently, could be substituted by the solution.

Make-up rooms differ from airport to airport especially in their automation level. Similarity can be detected in the little space. A possible solution, which encounters with the make-up room, has to fulfil the derived requirements.

The baggage claim area offers good potentials for an optimisation. Problems like energy supply and limited space exist to a lesser extent than at the aircraft interface. Merely the turnover from baggage carts to the conveyor of the terminal has to be done. Conveyor dimensions differ from airport to airport and the solution has to show compatibility.

Economic requirements

If the solution is technical realizable, economic requirements decide about the market opportunity and limit thereby technical scope. Furthermore it is assumed that a solution, that improves working conditions for the agents, but is more expensive than the current state, will be hard to be accepted by the airports.

Technical solutions of baggage flow on the apron are nearly constant for the last decades, because the cost pressure is immense. The robust and low-priced baggage carts in combination with 3 or 4 loading agents present an optimal cost situation. All in all the economic requirements can be summarized in an amortization period less than 2 years. The calculation of the amortization period implicates acquisition costs, implementation costs and running expenses, which are compared with the current solution.

EXPOSITION OF A POSSIBLE SOLUTION

Figure 3 shows a solution, which results from an intensive analysis of the current process and the derived requirements.

The obviously biggest problem for a technical solution is the separation of baggage. Currently 3 or 5 baggage carts in are pulled by a tractor. The train set drives past the beltloader and a ramp agent unloads the carts one after another. The bottleneck of the presented solution is the beltloader, because it measures nearly about 25 or 30 inches and the long side of the cart measures about 100 inches. When pushing, pulling or dumping the baggage, it may get jammed. To avoid this, the baggage compartment of the cart may turn its small side towards the beltloader. When the compartment measures 40 inches, the overhang is merely 4 or 8 inches and the risk of accumulation is minimized. Baggage is stacked up to 40 inches inside the compartment. This would be too much baggage at once for the agent inside the aircraft and hence it follows that this height has to be reduced. To fulfil this demand, the cart has a scraper, which just leaves an opening of 16 inches height. That is enough for a usual piece of baggage. If the force on the scraper gets too much, it opens and avoids damaging the baggage.

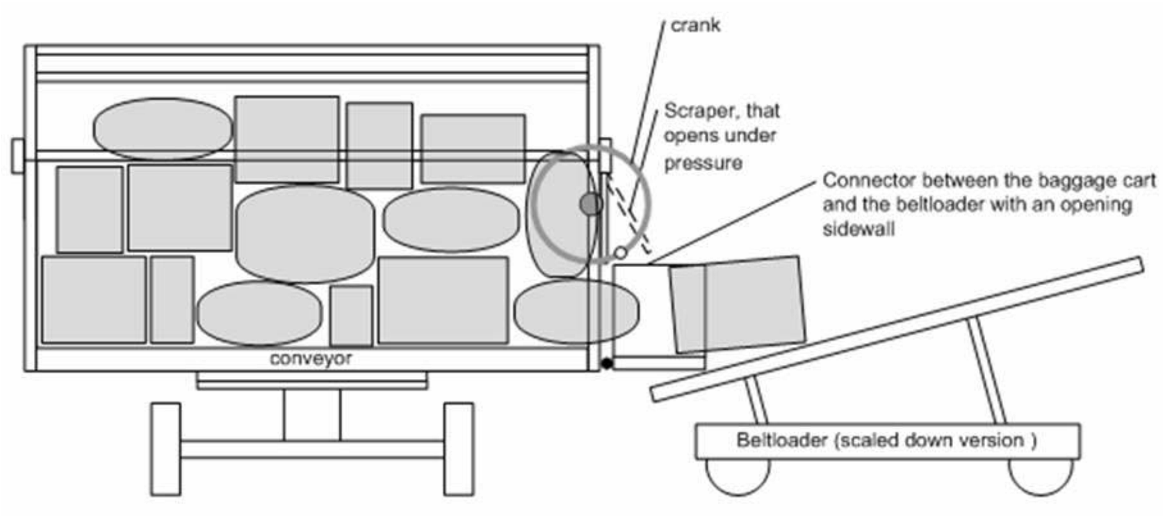

Fig. 4. Rotatable baggage cart with a conveyor
Rys. 4. Obrotowe wózki bagażowe z przenośnikiem

Baggage gets out of the cart by a conveyor that covers the whole bottom of the compartment of the cart. The force from the conveyor exerts only directly on the lower baggage layer and is comparable with dumping the load. The conveyor has an advantage in comparison with dumping the baggage, because it is better to power without electrical energy and is the solution that is less technical complex. The conveyor would be powered by a crank which is turned manually. Unloading the cart at the terminal may be powered by electrical energy instead of turning the crank.

Already the substitution of heavy lifting and rotating motions with turning a crank improves working conditions for ramp agents and leads to higher performance effectiveness. Lifting weights has only an efficiency of 5 or 10 percent, meanwhile turning a crank has efficiency over 20 percent [cp. Müller, Franz 1952].

SUMMARY

Based on the fact that this solution is technical realizable, the question comes up, whether the airport, the ground service provider and finally the ramp agents will accept it. Acquisition costs as well as running cost are likely to be higher than in the current situation.

On the other hand the solution avoids awkward and hazardous working conditions and speeds up unloading baggage at the terminal without raising the number of agents.

The quantity of needed agents would stick to 3 or 4 with the same skills compared to the current state.

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AKTUALNE TENDENCJE W SFERZE OBSŁUGI BAGAŻU NA LOTNISKACH - WYMAGANIA DOTYCZĄCE PRZEPŁYWU MATERIAŁU

STRESZCZENIE. Lotnictwo cywilne rozwija się coraz bardziej w kierunku masowego transportu pasażerskiego. Efektem tego stanu rzeczy jest to, że omawiana gałąź transportu znajduje się pod rosnącą presją kosztów. Tendencja ta jest coraz bardziej wyraźna dzięki silnemu wzrostowi segmentu rynku, jakim są tanie linie lotnicze. Dynamika rynku i specjalne wymagania przewoźników niskobudżetowych wymagają dostosowania procesu przepływu materiału na lotniskach.

Słowa kluczowe: obsługa bagażu na lotniskach, przeładunek bagażu, bagaż lotniczy, logistyka w portach lotniczych, odprawa bagażu

MATERIALFLUSSANFORDERUNGEN DURCH AKTUELLE ENTWICKLUNGEN IM GEPÄCKHANDLING AUF FLUGHÄFEN UND AKTUELLE TRENDS

ZUSAMMENFASSUNG. Dem Trend der letzten Jahre zur Folge entwickelt sich die zivile Luftfahrt immer mehr zu einem Massentransportmittel und ist damit einem immensen Kostendruck ausgesetzt. Diese Entwicklung wird unter anderem durch das starke Wachstum des Marktsegments der Low Cost Carrier deutlich. Das Marktwachstum insgesamt und die speziellen Anforderungen aus dem Low Cost Segment bedingen eine Anpassung der Materialflüsse auf den Flughäfen.

Codewörter: Gepäckhandling, Gepäckumschlag, Fluggepäck, Flughafenlogistik, Gepäcklogistik, Gepäckabfertigung.

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