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## POLISH AIR TRANSPORT AMONG STRUCTURAL CHANGES IN THE WORLD CIVIL AIRLINE FLEET

Summary. The predicted tripling of regional air carriage before the year 2027 sets extremely high requirements on future aircraft choice. The main competitors for a share of this market are Bombardier from Canada and Embraer from Brazil, followed by the French-Italian combination ATR. Having gone through a series of important changes since 1989, PLL LOT S.A. must also compete in this highly dynamic market. Its choices in equipment will have an important effect on its future market position.

## POLSKI TRANSPORT LOTNICZY W WARUNKACH ZMIAN STRUKTURALNYCH ŚWIATOWEJ FLOTY LOTNICTWA CYWILNEGO

Streszczenie. Przewidywany, trzykrotny wzrost przewozów regionalnych do roku 2027, stawia wyjątkowo wysokie wymagania dotyczące wyboru floty. W tym segmencie przedsiębiorstwami konkurującymi o zdobycie udziałów w rynku są: kanadyjski Bombardier, brazylijski Embraer, a przede wszystkim francusko - włoskie konsorcjum ATR. Podążając za serią istotnych zmian, zapoczątkowanych w 1989 roku, PLL LOT S.A. również musi konkurować na bardzo dynamicznie zmieniającym się rynku. Jego wybór dotyczący taboru będzie miał istotny wpływ na przyszłą pozycję rynkową.

## 1. MARKET DEMANDS IN THE REGIONAL FLEET SEGMENT

The important scope of services by the fleet of regional air transport aircraft, requires understanding of it's current commercial use, and knowledge about the changes in the production and exploitation of aircraft in this market. The competition between aircraft for regional operations takes place in the shadow of the spectacular process of fighting for the market for big planes. Yet the predicted triple rise of carriage to the year 2027 sets extremely high requirements in fulfilling the needs in this market too. The number of jet aircraft taking aboard from 30 to 120 passengers will soon rise from 4,7 to 9,2 thousand. Mostly these will be planes with a capacity of over 90 seats. Table 1 [18] shows the data concerning the changes taking place in the market of production and use of regional airplanes.

Production and orders of regional communication planes in years 2005 to 2007

| Type of the plane | Number of seats | Annual production |  |  |  | Number of orders |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  | 2004 | 2005 | 2006 | 2007 | 2007 | Remained for realisation |
| Jet airplanes |  |  |  |  |  |  |  |
| Embraer ERJ-135 | 37 | 1 | 2 | 0 | 0 | 0 | 0 |
| Embraer ERJ-145 | 50 | 87 | 46 | 12 | 7 | 1 | 46 |
| Embraer 170 | 70 | 46 | 46 | 32 | 11 | 13 | 31 |
| Embraer 175 | 78 | 0 | 17 | 11 | 34 | 30 | 70 |
| Embraer 190 | 98 | 0 | 12 | 40 | 68 | 88 | 282 |
| Embraer 195 | 108 | 0 | 0 | 3 | 10 | 14 | 47 |
| Bombardier CRJ 100/200 | 50 | 75 | 35 | 1 | 0 | 0 | 0 |
| Bombardier CRJ 440 | 40 | 33 | 12 | 0 | 0 | 0 | 0 |
| Bombardier CRJ 700/705 | 70-75 | 52 | 64 | 13 | 6 | 33 | 32 |
| Bombardier CRJ 900 | 86 | 15 | 14 | 50 | 56 | 69 | 84 |
| Bombardier CRJ 1000 | 100 | 0 | 0 | 0 | 0 | 39 | 39 |
| Domier 328 Jet | 33 | 8 | 6 | 1 | 0 | 0 | 0 |
| Total jet airplanes |  | 317 | 251 | 163 | 192 | 287 | 7 631 |
| Turboprop airplanes |  |  |  |  |  |  |  |
| ATR 42 | 48 | 5 | 5 | 8 | 7 | 16 | (173 |
| ATR 72 | 68 | 8 | 10 | 16 | 37 | 97 | 173 |
| Bombardier Dash 8Q 200 | 37 | 1 | 1 | 1 | 3 | 4 | 5 |
| Bombardier Dash 8Q 300 | 50 | 8 | 9 | 16 | 16 | 13 | 12 |
| Bombardier Dash 8Q 400 | 74 | 10 | 18 | 31 | 47 | 80 | 90 |
| Raytheon Beech 1900 | 19 | 1 | 0 | 0 | 0 | 0 | 0 |
| Total turboprop airplanes |  | 33 | 43 | 72 | 110 | 210 | - 300 |

The figures point out that in this segment the leading role is played by jet aircraft made by Embraer and Bombardier, and turboprop planes built by ATR. These three manufacturers delivered 302 airplanes in 2007, which represents a growth in sales by $44 \%$, compared to the previous year. One of the main factors causing this phenomenon was the expansion of low-cost air carriers who prefer using this particular type of aircraft. It significantly improved the financial situation of the Embraer company in particular. The main product of this Brazilian company is a family of E-Jets ( 70 to 122 seats). Their advantage is their unique quality to be used on routes with variations in air traffic density, the elimination of bigger planes from thin routes, and replacement of older types of planes which are not able to operate under low temperatures (-70--TUTAJ--C) or in hard weather conditions (these machines have an ETOPS75 certificate: 75 minutes of flight with engine malfunction). In passenger cabins it is possible to install TV screens in the back of the seats and electrical sockets for laptop users. In the Embraer's business class one rule is obligatory - "there's never enough comfort". In each plane this class is furnished with the most elegant chairs and sofas. A few years ago Embraer produced first in the world agricultural aircraft EMB-202A Ipanema, powered with biofuel (alcohol) made form sugar cane in the price of 1,3 real $(1,70 \mathrm{zl})$ when the price of gas reached 3,4 real (around 4,40zl).

On the regional transportation market the Canadian Bombardier is strengthening it's position. Sales of Bombardier planes in 2007 accounted for 238 machines ( 141 jet planes and 97 turboprop aircraft). The biggest of Bombardier's achievements is the program for construction and selling of a 100-seat model of its CRJ100, characterized by a reinforced undercarriage and modified wings. It was created in 2007. The general assumption of the constructors of both jet propelled and turbo propelled machines is extending the fuselage. After the emergence of the CL600 ( 20 m ) to the moment of production of the 90 seats CRJ900 ( $36,4 \mathrm{~m}$ ), the design was lengthened by $16,4 \mathrm{~m}$. These adaptations also incorporate improvements in comfort, which is closely connected with an increase of space as such. A quality offensive is also announced by the newest decision of constructing CSeries family plane, including four type of planes (with between 110 and 130 seats) that have a take-off weight from 55 to 60 tones and maximum range reaching from 3300 km to 5500 km . Planes with such
characteristics offer optimum flexibility for regional market demands. An advantage of these machines is that they have a modern construction made of aluminum-lithium alloy and composites, combined with digital avionics and fly-by-wire steering with joysticks instead of steering-wheels. The expected date of coming in exploitation of the first planes is year 2013.

The position of the third biggest producer on the world market for regional aircraft is the FrenchItalian ATR (Avions de Transport Regional). ATR's share in the market stands at around $15 \%$ and might go up more than $23 \%$. In its development strategy, the producer concentrated its efforts on quality improvement. The new versions of the ATR-42 (48 seats) and the ATR-72 (68 seats) will have modern, integrated digital avionics with liquid crystal displays inside the cockpit. Improvement in power plant will include using the latest Pratt \& Whitney Canada PW127M turboprop engines, that are reliable in high temperatures and high altitudes. The systematical improvement of the quality features in ATR aircraft made that this producer increased sales twofold in 2007 compared to the year before.

The evaluation of the regional market points to undisputed primacy of western aircraft producers in this field. In the east, the programs for the construction of regional planes differ. The most advanced aircraft is the Russian Suchoi Superjet 100. Apart from that, a limited number of modern An-148 aircraft are produced in Ukraine for the needs of the Commonwealth of Independent States(CIS). Chinese producers, however, show better efficiency. The AVIC ARJ-21 jet, available on the market from the end of 2007 , is designed to carry 90 passengers over a distance of 3700 km . The plane, for which already over 100 orders have been placed - it is estimated, that its production run can reach up to 900 units - is supposed to provide the producer acquisition of $60 \%$ of the regional Chinese market, mostly on the basis of low prices and high on-board comfort. The preferences of users of regional aircraft are more or less similar on every continent, which is illustrated by data in Table 2. (Own study on the basis of [18], [19])

In the world trends we can see a decrease in demand for planes with jet propulsion, which results from market saturation, and an increase in demand for turboprop machines, which are characterized by lower prices and 20 to $30 \%$ smaller fuel consumption. Nevertheless, the popularity of operating jet planes is not diminishing, due to their higher speed, which enables shortening of flight time.

## 2. FORECASTS

The evaluation of the present situation and the position of air transport in the nearest time is on the whole quite well defined. On the other hand, long-term forecasts regarding determinants and ways of air transport development are much more difficult. Global markets analysts agree that civil aviation will develop at a much faster rate than other kinds of economic activity. However there is some disagreement about how this will come about, and about the kinds of aircraft and equipment that will be in use.

The greatest uncertainty in a future evaluation is diagnosing the rate and scale of fuel price increases, and they comprise the main part of costs. A further problem is how the financial situation of companies will influence technical and technological levels of producers, airports and also the quality and size of equipment bought by users. The most useful in planning are projections prepared by the biggest aircraft producers, Boeing and Airbus, and the International Aviation Organization ICAO. Boeings forecasts concern regular and charter transports and the number of operational airplanes having over 90 seats. These forecasts are concerning the next twenty years and they are gathered in the document called Current Market Outlook - CMO. In its Global Market Forecast Airbus presents the regular and charter market projections and the demand on airplanes having above 100 seats. Analysts of ICAO published their forecasts in the document Civ. 313 Outlook for Air Transport to the Year 2025. This included cumulative statistics in domain of regular and charter traffic for the 189 members of ICAO, covering commercial airplanes having the takeoff weight above 9 tons. Table 3 (own study on the basis of [7], [9], [20]) gathers aerial producer and the International Aviation Organization forecasts, which shows a correspondence of these projections.

The number of the most popular regional planes in particular parts of the world

|  | Type of aircraft | Users by region |  |  |  |  |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  | North and South America |  |  | Europe and CIS |  |  | Asia and Middle East |  |  | Africa |  |  |
|  |  | 2006 | 2007 | change | 2006 | 2007 | change | 2006 | 2007 | change | 2006 | 2007 | change |
| 1 | ATR 42 | 106 | 105 | -1 | 125 | 131 | +6 | 50 | 55 | +5 | 31 | 31 | 0 |
| 2 | ATR 72 | 72 | 70 | 0 | 126 | 133 | +7 | 87 | 101 | +14 | 14 | 16 | +2 |
| 3 | Bombardier CRJ 100/200 | 748 | 767 | +17 | 144 | 136 | -8 | 40 | 40 | 0 | 6 | 13 | +7 |
| 4 | Bombardier CRJ 700 | 224 | 229 | +5 | 33 | 34 | +1 | 3 | 3 | 0 | 0 | 0 | 0 |
| 5 | Bombardier Dash 8/Q | 308 | 308 | 0 | 175 | 175 | 0 | 116 | 155 | +39 | 31 | 35 | +4 |
| 6 | De Havilland Twin Otter | 157 | 145 | -12 | 30 | 31 | +1 | 103 | 105 | +2 | 60 | 54 | -6 |
| 7 | Embraer EMB-110 | 115 | 93 | -22 | 4 | 3 | -1 | 33 | 23 | -10 | 8 | 6 | -2 |
| 8 | Embraer EMB120 Brasilia | 140 | 128 | -12 | 39 | 30 | -9 | 17 | 22 | +5 | 12 | 29 | +17 |
| 9 | $\begin{aligned} & \hline \text { Embraer } \\ & 135 / 140 / 145 \\ & \hline \end{aligned}$ | 680 | 687 | +7 | 141 | 135 | -6 | 20 | 24 | +4 | 7 | 8 | +1 |
| 10 | $\begin{aligned} & \hline \text { Embraer } \\ & 170 / 175 / 190 / 195 \end{aligned}$ | 124 | 175 | +51 | 28 | 45 | +17 | 15 | 27 | +12 | 0 | 5 | +5 |
| 11 | Fairchild Metro/Merlin | 246 | 246 | 0 | 50 | 50 | 0 | 73 | 63 | -10 | 8 | 7 | +1 |
| 12 | Fokker F27 | 38 | 30 | -8 | 40 | 38 | -2 | 46 | 42 | -4 | 40 | 37 | -3 |
| 13 | Fokker 50 | 15 | 15 | 0 | 85 | 86 | +1 | 50 | 52 | +2 | 20 | 20 | 0 |
| 14 | Fokker 100 | 57 | 59 | +2 | 112 | 110 | -2 | 58 | 58 | 0 | 3 | 3 | 0 |
| 15 | LET L-410 | 93 | 83 | -10 | 132 | 130 | -2 | 20 | 19 | -1 | 68 | 66 | -2 |
| 16 | Raytheon <br> Beech 1900C/D | 284 | 289 | +5 | 38 | 36 | -2 | 60 | 47 | -13 | 0 | 0 | +3 |
| 17 | SAAB 340 | 230 | 211 | 19 | 58 | 64 | +4 | 64 | 68 | +4 | 8 | 7 | -1 |
| 18 | Antonov An-24 | 23 | 23 | 0 | 328 | 323 | -5 | 68 | 67 | -1 | 29 | 25 | -4 |
| 19 | Antonov <br> An-26 | 35 | 35 | 0 | 184 | 169 | -25 | 19 | 20 | +1 | 29 | 26 | -3 |
| 20 | Jakovlev <br> Jak-40 | 16 | 16 | 0 | 357 | 347 | -10 | 17 | 18 | +1 | 20 | 19 | -1 |
| 21 | Jakovlev <br> Jak-42 | 7 | 7 | 0 | 120 | 123 | +3 | 0 | 2 | +2 | 3 | 1 | -2 |

These projections are based on presumption, that the number of flights in the next twenty years will increase from 24,9 million to 50,5 million and that the average number of seats in each airplane will grow from 181 to 215 , fulfilling an important criterion of increasing seat capacity. Very important information for producers is the volume of passenger and cargo transport in different regions of the world in terms of the necessity to include client expectations in future short-range aircraft. Detailed statistics regarding this problem are presented on Figure 1 (Own study on the basis of [20]).

Table 3
Long-term forecast of the global air transport market for years 2005-2025

| Source | Passengers |  |  |  | Cargo |  |  |  | The fleet in total |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | Total |  | Volume of transport performance |  | Total |  | Volume of transport performance |  |  |  |  |
|  | billion |  | Trillions of passenger-km |  | Billions of tonnes |  | Billions of tkm |  | 2005 | 2025 | remarks |
|  | 2005 | 2025 | 2005 | 2025 | 2005 | 2025 | 2005 | 2025 |  |  |  |
| Boeing | 2,1 | 5,25 | 3,7 | 10 | 37,7 | 143 | 143 | 560 | 17330 | 36000 | above 90 <br> seats |
| ICAO | 2 | 4,5 | 3,7 | 9,2 | 37,7 | 145 | 142 | 510 | 22133 | 44300 | takeoff <br> weight <br> above 9 <br> tonnes |

## In passenger transport



E=Asia / Pacific<br>Bit North America<br>ZEurope<br>2. Near East<br>South and Middle America<br>- Africa

In cargo transport


Fig. 1. Forecasts of the air transport performance volume in 2025 in particular regions of the world Rys. 1. Prognozy wielkości przewozów lotniczych w poszczególnych regionach świata w 2025 roku

Projections indicate that in 2025 North America will have the greatest share in passenger transport, followed by Asia and the Pacific, and Europe. In the domain of cargo transport Asia and the Pacific will be ahead of North America and Europe. In this case the opinions of the analysts of Boeing and Airbus coincide. They also agree about the predictable number of airplanes that will be bought in the future. Differences appear, however, in the evaluation of capacity usage (Airbus predicts a higher expansion of airplanes having above 400 seats). According to CMO authors projections of cargo transport, some $10 \%$ of the world carriage will be done by about 400 cargo airplanes in $2025(64 \%$ in wide-body aircraft, half of them with a carrying capacity above 80 tons). In comparison with 2007 the transport performance of goods will triple and the inventory of the fleet will double. About $25 \%$ will constitute of a typical cargo aircraft, and $75 \%$ of modified passenger-cargo aircraft. The evaluation of statistics presented in Table 4 (own study on the basis of [7], [9]) concerning the deliveries of commercial aircraft, gives a comprehensive view of projected changes in the civil aviation to 2026.

Table 4
Predictable volume of communication airplanes deliveries in 2007-2026

| Region | Number of aircraft |  |  |  | Total |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | Regional (shortrange) | Narrow-body aircraft | Wide-body aircraft |  | volume | Value in billions dollars |
|  |  |  | $\begin{gathered} \text { Max. to } \\ 400 \text { seats } \end{gathered}$ | $\text { above } 400$ <br> seats |  |  |
| Europe | 450 | 4630 | 1360 | 230 | 6670 | 660 |
| Asia/Pacific | 630 | 4690 | 2530 | 500 | 8350 | 1020 |
| North America | 1880 | 5840 | 1330 | 90 | 9140 | 730 |
| South America | 140 | 1370 | 210 | 10 | 1730 | 120 |
| Near East | 70 | 380 | 600 | 110 | 1160 | 190 |
| Africa | 70 | 270 | 150 | 0 | 490 | 50 |
| Countries of past USSR | 460 | 470 | 110 | 20 | 1060 | 70 |
| World in total | 3700 | 17650 | 6290 | 960 | 28600 | 2840 |

At present intensive competition is taking place among the leading producers of aircraft and aviation equipment. Increasing carrying capacity, range, convenience of travel, and economic effectiveness of machines is paramount in this. Boeing has announced the start of a research project on a supersonic airplane, identified under its work name 20XX, or Sonic Cruiser. The presumptions of this project have been concentrated on obtaining a maximum range and flight speed of 0,95 Mach $(1057 \mathrm{~km} / \mathrm{h})$ and on achieving a substantial reduction of aerodynamic drag during high speed flight. Boeing has also started a study into an airplane having about 800 seats without an isolated fuselage, a so-called blended wing body (delta shape).

Not to stay behind, Airbus has started research on a forward model identified as E2, which focuses on the assumption that supersonic transport aircraft with rotary wings will be built. Within the European Union a special group of scientists was also created to work on a project for a supersonic jet, called A2, flying at five times the speed of sound (Mach 5), i.e. two times faster than Concorde, which has been withdrawn from operation in 2003. This project takes into account strict requirements in the domain of ecology and seeks to use hydrogen fuel, which does not pollute the atmosphere.

## 3. STRUCTURAL CHANGES IN THE POLISH CIVIL AVIATION

The Polish civil aviation rests on one main pillar, which is LOT Polish Airlines, existing on the market since year 1929. The fleet of this company, which has the status of a national carrier, underwent changes dependent on political conditions to the moment of converting it to Joint Stock

Company in December 1992. This made that LOT found itself in an area of operation in which the market economy rules. Table 5 contains data showing the size of quantitative changes of the basic equipment after World War II.

Table 5
Civil Aircraft Register in the Polish civil aviation for years 1945 to 2008
(as of the 1st of the January of every year) [25]

| Years | Type of equipment |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: |
|  | Airplanes | Helicopters | Gliders and motor gliders | Balloons and airships | Total |
| 1945 | 3 | - | 138 |  | 142 |
| 1950 | 211 | - | 751 | - | 624 |
| 1955 | 291 | - | 597 | - | 693 |
| 1960 | 506 | 3 | 858 | 4 | 1290 |
| 1965 | 564 | 13 | 790 | 5 | 1585 |
| 1970 | 500 | 13 | 758 | 4 | 1273 |
| 1975 | 624 | 27 | 958 | 2 | 1611 |
| 1980 | 782 | 134 | 958 | 5 | 1879 |
| 1985 | 864 | 149 | 922 | 7 | 1942 |
| 1990 | 936 | 203 | 987 | 38 | 2164 |
| 1992 | 912 | 232 | 971 | 47 | 2162 |
| 1994 | 933 | 228 | 949 | 53 | 2163 |
| 1996 | 918 | 214 | 929 | 67 | 2128 |
| 1998 | 845 | 164 | 919 | 83 | 2011 |
| 2000 | 922 | 161 | 897 | 96 | 2076 |
| 2002 | 970 | 165 | 904 | 101 | 2140 |
| 2004 | 1007 | 122 | 869 | 105 | 2103 |
| 2005 | 1064 | 124 | 879 | 116 | 2183 |
| 2006 | 1123 | 129 | 898 | 124 | 2274 |
| 2007 | 1151 | 126 | 913 | 137 | 2327 |
| 2008 | 1161 | 143 | 869 | 136 | 2309 |

At the beginning of the 1990s Soviet airplanes were dominant in Polish civil aviation. Internal connections were operated with the Antonov An-24 (44 seats) and Jakowlev Jak-40 (24 seats). International connections to capital cities of the CMEA (Council for Mutual Economic Assistance) countries were served by Tupolev Tu-134. For the service of the few routes to Western Europe and the Near East Tu-154 (140-166 seats) were used. Despite the difficulties resulting from political pressure, LOT held on to the operation of lines to Asia (Singapore, Delhi) and the United States (New York, Chicago, Detroit, Los Angeles), which were served also by Soviet airplanes, particularly the Ilyushin Il-62M (174 seats). The 1990s are also a time of overcoming the hegemony of Soviet equipment. Western producers offered planes with characteristics that were significantly ahead of Soviet aircraft. The main difference consisted in vital reduction of fuel consumption, decreasing the unit weight of passenger seats through the application of new materials, modern engines and more reliable avionics. Such features made for economic efficiency and increased the commercial attractiveness of these aircraft, which was important for the competitive position under market conditions of air services. In this period the obsolete and uneconomical An-24, Yak-40, Il-18 models were gradually withdrawn and partly replaced with more modern medium-range Tu- 154 planes and with present-day western ATR72 and ATR-42 models of French-Italian production, which started working for LOT in year 1991.

Similar replacements were also carried out in the long range segment. In the place of Tu-134 and Il-62M introduction of American Boeing started, whose arrival in exploitation was a breakthrough in Polish civil aviation. The years between 1990 and 1993 were a time of great changes in the Polish civil aviation fleet, in which conversion to a new generation of models of western, mostly American, aircraft was effected. The first Boeings 767-200ER were bought in 1989, augmented in 1991 by the B737-500 and in 1993 by the B737-400. As result of this, LOT became the first and only national carrier among the Eastern Bloc countries, which exclusively operated planes of western production. This process still continues and is characterized by the increase of modern machines, which is illustrated by data contained in Table 6 (Own study on the basis of [21, 24]).

PLL LOT Fleet (including EuroLOT) in years 2002 to 2008

| Type of the plane | Range | Number of seats |  |  | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  | Total | BC | EC |  |  |  |  |  |  |  |
| Boeing 767200 ER | 12600 | 202 | 12 | 190 | 2 | 2 | 2 | 2 | 2 | - | - |
| Boeing 767-300 ER | 11700 | 243 | 18 | 225 | 3 | 3 | 3 | 5 | 5 | 7 | 7 |
| Boeing 737-300 | 2352 | 145 | - | 145 | 2 | 2 | - | - | - | - | - |
| Boeing 737-400 | 2860 | 147 | 48 | 99 | 7 | 7 | 3 | 3 | 2 | 2 | 2 |
| Boeing 737-500 | 2150 | 108 | 36 | 72 | 10 | 7 | 6 | 6 | 6 | 6 | 6 |
| Embraer 175 | 2450 | 82 | - | 82 | - | - | - | - | 6 | 4 | 6 |
| Embraer 170 | 3000 | 70 | - | 70 | - | 16 | 10 | 10 | 10 | 10 | 10 |
| Embraer ERJ-145 | 1500 | 48 | - | 48 | 14 | 14 | 13 | 11 | 9 | 9 | 9 |
| ATR 72 | 1500 | 64 | - | 64 | 8 | 8 | 8 | 8 | 8 | 8 | 8 |
| ATR 42 | 1500 | 48 | - | 48 | 5 | 5 | 5 | 5 | 6 | 5 | 6 |

An analysis of presented values indicates that the process of change is still ongoing. For example the share of the 48 -seat Embraer ERJ-145 is decreasing and it is replaced by the latest model of Embraer-170 and the 82-seat Embraer-175. These aircraft represent unique technical and technological solutions, and also functions improving the comfort of travel. Their main advantage, however, is low fuel consumption per seat.

The exchange of the fleet under market conditions is a basic process. It gives the chance to increase both economic advantages and the demand attractiveness, gaining momentum in terms of tightening up the competition in area of usage, stimulating at the same time rivalry in the domain of production. The results if this process can be seen in the changing number of aircraft used and in the structure of using particular models. The present register of Polish airlines aircraft is presented in Table 7 (own study on the basis of [9, 10, 22, 23]).

In the last period there have been seen important changes in the LOT's fleet inventory. A regional corporation Eurolot (1997) separated from LOT took over the ATRs 42 and 72. A similar process took place when the dependent partnership Centralwings (2005) was created. This corporation took over 9 Boeings 737-400 for transport services in the low cost segment.

Register of Polish airlines aircraft in 2007-2008 (as of the $1^{\text {st }}$ January)

| $\underset{\sim}{\circ}$ | PLL LOT <br> EuroLOT Centralwin gs |  |  | Aeroclubs Flying schools |  |  | Ambulance planes Agriculture planes Private firms |  |  | Privately owned equipment |  |  | Total |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | $\hat{N}$ | ત્તે |  | $\hat{i}$ | $\underset{\sim}{\infty}$ |  | $\hat{\mathrm{N}}$ | $\stackrel{\infty}{\text { ¢ }}$ | 淢 | ले | ¢ |  | N | ¢ | 呙 E E U |
| Airplanes |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| - Boeing 767 <br> - Boeing 757 <br> - Boeing 737 <br> - Embraer 175 <br> - Embraer 170 <br> - Embraer 145 <br> - ATR 72 <br> - ATR 42 <br> - SAAB 340 <br> - Tupolev <br> - An 26 <br> - Cessna <br> - An 2 <br> - PZL-104-Wilga <br> - Other types | $\begin{array}{r} 7 \\ - \\ 17 \\ 4 \\ 10 \\ 9 \\ 8 \\ 5 \\ - \\ - \\ - \\ - \\ - \\ - \\ - \end{array}$ | $\begin{array}{r} 7 \\ - \\ 17 \\ 6 \\ 10 \\ 9 \\ 8 \\ 6 \\ - \\ - \\ - \\ - \\ - \\ - \\ - \end{array}$ | $\begin{array}{r} - \\ +2 \\ - \\ - \\ -1 \\ + \\ - \\ - \\ - \\ - \\ - \\ \hline \end{array}$ | - - - - - - - - - - 31 55 77 230 | $\begin{array}{r} - \\ - \\ - \\ - \\ - \\ - \\ - \\ 43 \\ 52 \\ 67 \\ 182 \end{array}$ | $\begin{array}{r} - \\ - \\ - \\ - \\ - \\ - \\ - \\ - \\ - \\ - \\ +12 \\ -3 \\ -10 \\ -48 \end{array}$ | $\begin{array}{r} - \\ 1 \\ - \\ - \\ - \\ - \\ - \\ 4 \\ 6 \\ 7 \\ 6 \\ 84 \\ 84 \\ 19 \\ 262 \end{array}$ | $\begin{array}{r} - \\ 1 \\ - \\ - \\ - \\ - \\ - \\ 4 \\ 9 \\ 5 \\ 6 \\ 118 \\ 83 \\ 19 \\ 293 \end{array}$ | $\begin{array}{r} - \\ - \\ - \\ - \\ +3 \\ -2 \\ - \\ +34 \\ -1 \\ - \\ +31 \end{array}$ | $\begin{array}{r} 55 \\ 12 \\ 5 \\ 153 \end{array}$ | $\begin{array}{r} 43 \\ 13 \\ 5 \\ 55 \end{array}$ | $\begin{array}{r} -12 \\ +1 \\ - \\ +2 \end{array}$ | 7 1 17 4 10 9 8 9 6 7 6 170 151 101 645 | 7 1 17 6 10 9 8 10 9 5 6 204 148 91 630 | - - - +2 - - - +1 +3 -2 - +34 -3 -10 -15 |
| Total number of aircraft | 60 | 63 | +3 | 393 | 344 | -49 | 473 | 538 | +65 | 225 | 216 | -9 | 1151 | 1161 | +10 |
| Helicopters |  |  |  | 1 | - | -1 | 117 | 133 | +16 | 8 | 10 | +2 | 126 | 143 | +17 |
| Motorgliders |  |  |  | 6 | 6 | - | 5 | 5 | - | 22 | 21 | -1 | 33 | 32 | -1 |
| Gliders |  |  |  | 736 | 684 | -52 | 34 | 29 | -5 | 110 | 124 | +14 | 880 | 837 | -43 |
| Balloons |  |  |  | 29 | 26 | -3 | 62 | 63 | +1 | 45 | 46 | +1 | 136 | 135 | -1 |
| Airships |  |  |  | - | - | - | - | - | - | 1 | 1 | - | 1 | 1 | - |
| Total | 60 | 63 | +3 | 1165 | 1060 | -105 | 691 | 768 | +77 | 411 | 418 | +7 | 2327 | 2309 | -18 |

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Received 21.08.2008; accepted in revised form 7.03.2009

