

Challenges to the global aerospace industry due to the pandemic epidemic of COVID-19

D. Liptakova*, J. Kolesar*, M. Keselova*

* Faculty of Aviation, Technical University of Kosice, Slovakia
dorota.liptakova@tuke.sk, jan.kolesar@tuke.sk, michaela.keselova@tuke.sk

Abstract—The novel coronavirus SARS-CoV-2 caused a worldwide pandemic of COVID-19. To halt its spread, countries around the world have gradually reduced international traffic, closed down operations and imposed social distancing rules. Aviation is one of the sectors that has experienced these restrictions in great intensity. The article describes the specific problems encountered by air carriers as well as airports, aircraft manufacturers and other sectors directly linked to the existence of the aviation industry. The second part of the article focuses on the comparison with previous crises of different origin using aggregated data about world air transportation. Based on this we evaluate the prospects for the aviation industry. We conclude, that the recovery from the current crisis in aviation will depend on the economic recovery as well as restoring the confidence of the travelling public.

I. INTRODUCTION

The year 2020 is still in progress but it is already clear that it will go down in history as the year when the society faced the first global pandemic in the new millennium. This was caused by the SARS-CoV-2 virus, which was probably caused by mutations in animal coronavirus and transmitted to humans in China's Hubei province by the end of 2019. The virus causes disease with flu-like syndromes and is called COVID-19, Corona Virus Disease 2019, that is, a disease caused by a coronavirus.

The new disease was first observed in the capital of the Chinese province of Hubei called Wuhan. While the first cases date back to November, it was not until the end of December as the new potential virus started to be discussed on an international forum. [1] Meanwhile the virus spread from China to other parts of the world. The first country hit hard was South Korea. Later, Italy became the new epicentre of the disease, but the virus spread to all of Europe. Later, the United States saw a significant increase in the number of infected and dead, South America and Africa following later.

Although we have faced the pandemic and its repercussions for months now, no one can yet estimate how the whole situation will develop and how long it will take. Various prediction models have emerged that estimate the possible course of the pandemic, use different rates of disease transmission in the community, and the duration of the measures. However, these models can only build on past crises and compare their outputs with the past. Nevertheless, the current situation is so unprecedented that the functionality and accuracy of the models will only be verified over time.

But one thing is certain. The current crisis will forever go down in history as a period of social distancing and

isolation. Specifically for the aviation industry, March 2020 will be the month when the world has almost stopped. To prevent further spreading, travel bans have been introduced and several months into the pandemic the situation for air travel is still dire. The following text summarizes the problems so far that the SARS-CoV-2 virus has caused to both airlines and the wider aviation industry. We also use available data on the number of passengers (PAX) transported globally in the past 30 years and put it in context with other major events which impacted the global air transport. The goal is to explain the possible development of air transport in the near future.

II. IMPACT OF THE PANDEMIC SITUATION ON THE AVIATION INDUSTRY

Although the current situation paralyzes the whole world it must be acknowledged that the aviation industry is one of the sectors most affected by the current crisis. SARS-CoV-2 is a new pathogen to which society has not developed herd immunity. There are also no drugs or vaccines to help defeat the virus quickly and effectively. The only reliable method is to avoid personal contact and thus minimize the risk of pathogen transmission. Therefore, one of the first measures introduced by governments around the world was a travel ban.

A. Impact on airlines

First impacted were the routes between China and the rest of the world. Airlines had to gradually disrupt regular services or reduce frequencies. However, the financial impact of this move was relatively small, mainly due to the strong position of Chinese airlines, which dominate most of the air transport market between China and the rest of the world. And since Chinese carriers are mostly state-owned, their economic survival should not be problematic. Asian companies such as Scoot, Cathay Pacific and the Japanese ANA felt a greater impact. At the time, however, it was a matter of limiting only part of their operation.

The gradual spread of the virus brought with it restrictions on air connections to other parts of the world - to South Korea, Iran, Italy, and the subsequent spread of the virus caused the suspension of most flights around the world. On March 11, US President Donald Trump appeared on national television and announced a ban on the entry of foreigners coming to the US from Europe. The great surprise among the representatives of the European institutions suggests that he did not consult this step in advance. In practice, the ban has meant a reduction in frequencies, and especially the disruption of flights on

most routes between the US and Europe. Same changes have taken place in international air transport around the world.

Eventually, for several weeks commercial flights were suspended almost entirely. The remaining capacity was several tens of per cent on domestic flights and several per cents on international flights. Many airlines have therefore decided to ground their aircraft, transferring them to long-term parking facilities. The charges for such parking are lower than if the aircraft remained at the busy airport. However, returning such aircraft to service is not easy. They lose their airworthiness in the long run. Before returning them, airlines will have to pay for the appropriate inspections and maintenance, which will also delay the return by several days.

Even during the time of travel band some aircraft remained in operation and flew empty. The reason was to maintain the allocated airport slots. Large international hub airports often operate to their full capacity. Therefore, airlines wishing to use them must engage in slot coordination. Slot means a specific time interval during the day when an aircraft is to land and take off again and in the meantime can use the airport infrastructure. Airlines that already have specific slots allocated must use them for at least 80 %, otherwise, they will lose them and the slots will be made available to other airlines. Slots can also be traded. At the busiest airports, buying a slot from another airline can be an investment of tens of millions of dollars. [2] This forces airlines to fly all the time, even though they do not carry any passengers on board. They perform so-called ghost flights. However, each such flight represents a net loss for the airlines.

Another example of flights with an empty deck can be seen at Ryanair. Their goal was not the slot preservation. Ryanair, with its business model, tends to use smaller airports that do not have slot coordination. The low-cost carrier just wanted to avoid the costs associated with returning grounded aircraft. For the aircraft to remain airworthy, each machine flew out of the airport where it is parked approximately once every 4 days, made a small circle and landed again. In this way, all Ryanair aircraft would be immediately ready for entry into service. [3]

Other aircraft that remained in service were used for transporting cargo. Although the world economy has slowed down and there was less demand for transporting goods and freight, a new need arose to transport medical supplies and equipment and humanitarian aid. Other flights were used for the repatriation of persons who were stranded in a foreign country after the closure of borders and traffic restrictions. They are mostly transported as part of charter flights, ie one-time booked flights. However, one airline was able to take advantage of the need for repatriation flights and increased the frequency and capacity of flights on selected routes during this period. This is Qatar Airways. [4]

In addition to the grounding of aircraft, another exceptional step taken by carriers was the decision to retire the high capacity planes 747 by Boeing and A380 by Airbus. Many early retirements of smaller aircraft also took place, as well as cancellations of orders for new aircraft, or delaying of deliveries. [5]

B. Impact on airports

Airlines are not the only ones calculating losses due to declining demand. Their main partner, airports, also lost their source of income as without passengers they don't receive any passenger fees. At the same time, they also lose income from concessionaires, who have no one to sell their goods to at airport terminal buildings. One of the certain revenues is parking fees and aircraft storage. In reaction, the iconic London Heathrow Airport has decided to reduce its operations and temporarily closed the T3 and T4 terminal. All airlines were redirected to T2 and T5 terminal. The airport thus consolidated its activities and at the same time creating space around closed terminals for aircraft parking.[6]

The airports also started to prepare for a new reality of air transport. Many accelerated the implementation of new technologies such as biometrics and face recognition to avoid fingerprint scanning. Mobile applications are being introduced to allow for touchless, contactless and self-service passage through the airport, but also to shop in duty-free zones and order food and beverages to pick-up.[7]

C. Impact on aircraft manufacturers

The coronavirus pandemic has also affected aircraft manufacturers. First of all, they face the same problems as other industries, t.i. limitations in factory operations, decrease in the number of workers and breaks and bottlenecks in supply chains.

On the other hand, airlines are re-evaluating their plans and cancelling orders, or changing delivery dates and postponing them to a later period. This means shifting the delivery by several months to years.

In the case of Airbus, the manufacturer reported a decrease in the production capacity of its aircraft by about a third, which will also be reflected in the company's financial results for this year. However, they have been successful in the previous period and the current situation should not jeopardize the long-term survival of the company.

Boeing has bigger problems. It was already suffering due to the 737 Max crash, following lawsuits and the need for re-certification. Before the Corona crisis, the expectation was that Boeing would recover after a short-term crisis, but now long-term survival of the company is endangered. However, the American manufacturer is one of the largest American exporters. It provides employment directly and in the supply chain to more than 2.5 million people. It is also a key partner of the US government and the US Air Force. So it is more than certain that Boeing will receive some form of financial support from Congress to keep them afloat.

D. Impact on other sectors linked to the aviation industry

The International Air Transport Association (IATA) is closely monitoring the development of the coronavirus situation and its impact on the aviation industry. In June IATA calculated that declining interest in air travel could threaten up to 32 million employees worldwide, including tourism. In April the estimate was only 25 million jobs.[8]

III. PROSPECTS FOR THE AVIATION INDUSTRY IN THE CURRENT SITUATION

To better understand the possible impact on global aviation, it is useful to look at the previous crisis. In Table 1 we show the annual number of transported passengers from 1998 and with respective years we indicate the crisis, which had an impact on the aviation on a broader scale.

It is important to acknowledge that any type of crisis will have a financial impact, whether it's a financial crisis, a health crisis or a natural disaster. For example, the Eyjafjallajökull eruption caused the closure of airspace in Europe and between Europe and North America, thus impacting airlines with flights scheduled in this space.

In the case of a previous health crisis, we can look at the SARS outbreak in 2003, avian flu in 2005 and 2013, swine flu in 2009 and the MERS outbreak in 2015. First of all none of these outbreaks happened in such a pandemic scale as the SARS-CoV-2 outbreak. For example, the first SARS outbreak caused less than 1000 deaths globally, but it had significant economic damage on several economies, especially those of East Asia and North America. At the height of the epidemic in May 2003 the monthly revenue passenger-kilometres (RPKs)

of Asia-Pacific airlines fell at about 35 %, the annual RPKs of Asia-Pacific airlines fell 8 %. Even though the epidemic caused a loss of confidence of the travelling public, both business and leisure travel, the monthly international passenger traffic returned to its pre-crisis level within nine months.

Other epidemics caused even less damage. The two episodes of avian flu showed less danger to the public and air travel resumed very quickly. The MERS flu impacted mostly travel to and from South Korea with RPKs declining by 12 %, but the travel volume recovered fairly quickly and returned to previous levels within 6 months.

On the other hand, the global financial crisis can have a major impact on aviation which is greatly correlated with the financial cycle. An economic downturn impacts business travellers, as well as cargo flights as there is less international trade and goods to be shipped. Leisure travel is also impacted, as people have less money to spend on vacations and travel. The global financial crisis of 2008 clearly impacted the aviation for several years.

The current situation caused by the SARS-CoV-2 pandemic looks dramatic for the aviation industry. However, it is necessary to look at it from the other side as well. The year 2019 was marked by the bankruptcy of more than 20 airlines. The current crisis will clear the industry of weak and poorly managed airlines. Their resources will be able to be used elsewhere, whether it is aircraft, airport slots but also employees. Many airlines are struggling with a shortage of pilots. This will allow resources to be redistributed and used by stronger players.

Although the current situation will affect everyone and will certainly endanger large airlines with a long history, we do not have to worry about the demise of aviation. There are companies on the market that have prospered in the past and now have a better starting position compared to the aviation crisis after 9/11. Examples are United Airlines, American Airlines and Delta Airlines, which had operating margins of 6.8%, 6.5% and 12.7% in 1999. In 2019, these margins reached 9.9%, 6.6% and 14.0%, which is also illustrated in Fig. 1. After 9/11 several airlines, which were then operating on the market, have undergone recovery processes and are now better prepared to face the consequences of another similar event. The approach of airlines for handling the situation also changed based on their previous experience. After September 11, 2001, US airlines had been forced to stay on the ground for several days, facing large financial losses and subsequent falling demand and additional costs due to security measures. As early as 4 days after

TABLE I.
PREVIOUS CRISES IMPACTING GLOBAL AVIATION

Year	PAX in billion	Year-over-year change	Crisis	Type of impact
1998	1,467	-		
1999	1,562	6,55		
2000	1,674	7,17	Dot-com Bust	Financial
2001	1,655	(1,14)	9/11	Consumer confidence
2002	1,627	(1,69)		
2003	1,665	2,34	SARS	Consumer confidence
2004	1,889	13,45		
2005	1,97	4,29	Avian Flu	Consumer confidence
2006	2,072	5,18		
2007	2,209	6,61		
2008	2,208	(0,05)	Global Financial Crisis	Financial
2009	2,25	1,90	Swine Flu	Consumer confidence
2010	2,628	16,8	Eyjafjallajökull Eruption	Financial
2011	2,787	6,05		
2012	2,894	3,84		
2013	3,048	5,32	Avian Flu	Consumer confidence
2014	3,227	5,88		
2015	3,466	7,41	MERS	Consumer confidence
2016	3,705	6,9		
2017	3,974	7,26		
2018	4,233	6,52		
2019	4,543	7,32		

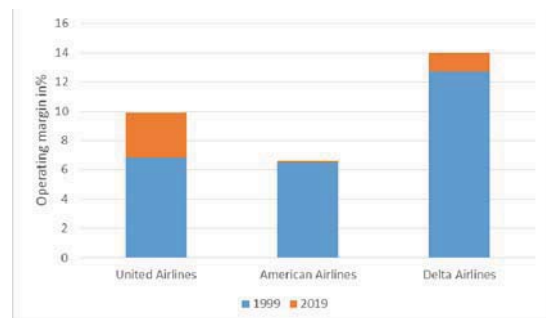


Figure 1. Operating margin of the largest US airlines in 1999 and 2019 [9].

September 11, large US airlines laid off about 40,000 employees. In the weeks following the attacks, that number rose to 75,000. In the current crisis, airlines approached the possibility of lay-offs carefully. In the US airline employees are being kept thanks to emergency funding from the government. This will end in September and as the pandemic situation in the US is far from being stable, the airline workers are facing significant redundancies.[9]

A small victory, especially for environmental activists, is the fact that airlines have begun to get rid of older types of aircraft. It is normal for airlines to try to renew their fleet. Many are even proudly presenting the low average age of their aircraft in marketing campaigns. Disposal of older pieces is common due to their wear, rising maintenance costs and also due to older technologies and higher fuel consumption. In the current situation, however, we observe early retiring of aircraft which were supposed to stay in service at least until the end of this season or next year. The fall in demand means excessive aircraft can be scrapped already to minimize at least some costs, for example for parking and maintenance of aircraft. At the same time, the decommissioning of these machines means a complete rejuvenation of the world's fleet and the elimination of older, less fuel-efficient machines. [10]

Professional organizations and analytical groups are already trying to evaluate and quantify the impact of the pandemic on the world economy, or specifically on aviation. The problem, however, is that no one can reliably estimate how long this situation will last. Another variable is consumer behaviour after a pandemic. Even during the recent crises, such as the slowdown in demand after 9/11 or the global economic recession of 2008 and 2009, people have not stopped flying. Year-on-year growth in air transport slowed down significantly, but with the restoration of confidence in the aviation, resp. after the economic recovery, it returned to previous year-on-year growth. However, the current crisis is forcing us to stay at home and change our usual behaviours. People are forced to work remotely. Conferences, meetings of government officials or business negotiations with potential partners take place online, via video chat. Given the potential recession, this may currently be a way to save some of the company's costs. If the pandemic situation continues for a longer period, many companies may introduce video conferencing as a new standard. This would significantly affect the market of business travellers. It is further expected that even after the pandemic subsides, the SARS-Cov-2 virus will remain in the population as a common influenza virus. Therefore, it can be expected that in the future, people will consider travel plans more carefully, which may also affect the segment of leisure travellers. Although the aviation industry will recover from the crisis, it is questionable whether this time it will return to its pre-crisis growth rate at all.

IV. CONCLUSION

While aviation faced many crises in the previous 20 years, the novel Coronavirus poses a tough obstacle to the global community. While many incidents such as 9/11, the SARS outbreak in 2003 or the eruption of Eyjafjallajökull caused effective close down of air travel in certain areas of the world, this time the closure and subsequent distrust of the travelling public caused an unprecedented drop in demand. The whole situation is complicated by the economic crisis. IATA analytics expect the travel volumes to return not sooner than in 3 to 5 years. On the other hand, the current crisis could purify the industry in several ways. First is the elimination of weak airlines, as previous years showed a growing trend in airline bankruptcies. Second, current missing demand leads to the early retirement of older planes, thus influencing the aviation carbon footprint positively.

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