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Modern means of air transportation: state of the art and development prospects

This article analyzes the current state of air transportation, identifies key trends and forecasts the industry's development prospects. The current state of air transportation, its main assets and prospects for development in the face of new challenges are considered.

Air transport has undergone significant transformations in recent decades. Continuous technological development, global economic growth and globalization have contributed to the rapid growth of the aviation industry. Rapid scientific and technological progress over the past few decades has led to significant changes in the air transportation industry. Innovations in technology, growing demand for fast transportation, and the globalization of the economy have contributed to the expansion and improvement of this industry. Therefore, the study of the current state of air transportation, its fixed assets and prospects for development in the face of new challenges is relevant and timely. [1]

Air transportation (air transportation) is a method of transportation of goods, mail and passengers by means of aircraft. Aircraft is an aircraft; aircraft include manned aircraft with a crew or pilot on board who controls the aircraft and unmanned aircraft controlled by an operator from the ground or flying automatically according to a pre-set program. Air transportation can be classified into two main types: passenger and cargo. According to the International Air Transport Association (IATA), in 2022, global passenger traffic increased by 50% compared to 2021, indicating the recovery of the air transportation industry after the COVID-19 pandemic. Modern airlines offer a variety of classes of service to meet different customer needs. The demand for air cargo transportation is driven by the growth of e-commerce. Cargo aircraft provide fast delivery of goods, which is critical for many businesses. [2]

Modern innovative technologies play a key role in the development of aviation. Today, air transportation is one of the fastest and most popular ways to travel long distances. Due to the continuous improvement of aircraft, expansion of aviation infrastructure, and lower airfares, the demand for air travel continues to grow. The main areas of emerging technologies include autonomy, environmental friendliness, and the digitalization and individualization of services. [6] Unmanned aerial vehicles open up new prospects for cargo transportation, particularly in hard-to-reach regions. Modern digital technologies increase the efficiency of airlines in such processes as booking, passenger service, and flight management. Modern aircraft are equipped with the most advanced navigation, control, and safety systems. New materials, more efficient engines and aerodynamic shapes help to reduce fuel costs and harmful emissions, which is confirmed by the introduction of new aircraft models (Boeing 787, Airbus A350 and others), [4,5] the use of which reduces fuel consumption and harmful emissions. Also, the analysis of the current state shows that airports around the world are constantly expanding and modernizing to cope with the growing passenger traffic. New technologies are being introduced to speed up customs/passport control and

document processing. The emergence of low-cost airlines has significantly reduced airfares, making air travel more affordable for a wide range of consumers. Airlines are increasingly paying attention to the individual needs of passengers, offering a variety of additional services and loyalty programs. Air transport plays an important role not only in the transportation of passengers but also in global supply chains. Speed, reliability and the ability to deliver almost any cargo to any part of the world have made air cargo transportation indispensable for many industries.

The current state of air cargo transportation is characterized by the following features. The use of specialized cargo aircraft, which are designed specifically for cargo transportation, have large cargo compartments and can carry oversized and heavy cargo. Airlines also use the free space in passenger aircraft to transport cargo, which increases their profitability. The use of standard containers simplifies the process of loading, unloading and transportation of goods. Containerization and specialized logistics centers at airports ensure efficient cargo handling and fast delivery to the final destination. [5]

Considering the prospects for the development of air transportation, it should be noted that the growth of international trade and population mobility requires the expansion of the air transportation network. The expansion of aviation infrastructure, namely the development of regional airports and the construction of new cargo airports and the modernization of existing ones, will increase the capacity and efficiency of air cargo transportation. Investing in small airport infrastructure will provide better accessibility to remote areas and the development of regional air transportation. The increase in the number of regional airports and the emergence of new types of aircraft with short runways open up new opportunities for the development of regional air transportation.

Technological innovations are giving a powerful impetus to the development of unmanned aircraft and flight automation. [3] Unmanned aerial vehicles can be used to deliver small cargoes over short distances, which is especially important for regions with a developed road network. In turn, the introduction of automatic flight control systems will improve flight safety and reduce the workload of pilots. The use of the Internet of Things technology will allow tracking the movement of goods in real time, which will increase the transparency and efficiency of logistics processes. The development of 3D printing technologies will make it possible to produce spare parts and other necessary components directly on board the aircraft or at destinations, which will significantly reduce delivery time. Thanks to the development of digital technologies, airlines will be able to provide more personalized services to their passengers: the introduction of artificial intelligence in flight management and passenger services will increase efficiency and safety. In the future, new areas such as space tourism may emerge, opening up new horizons for the development of the aviation industry.

One of the main challenges for the aviation industry is to reduce its environmental impact, so environmental friendliness is among the key areas of technology development in the aviation industry. The use of alternative fuels and route optimization are key factors in ensuring the environmental sustainability of the industry. The use of composite materials will reduce the weight of aircraft and increase their fuel efficiency. In this area, active research is underway to develop electric and

hydrogen aircraft, as well as new types of biofuels. Biofuels and hydrogen technologies can become important elements of the emission reduction strategy, while the use of the latest navigation technologies will reduce fuel consumption and increase flight efficiency. [6]

Despite positive prospects, the air transportation industry faces a number of challenges. The ever-growing demand for air transportation requires an increase in flight safety. The development of rail and road transport, as well as the emergence of new technologies such as hyperloops, may create additional competition for airlines. Air cargo transportation is one of the most expensive modes of transportation. Rail and sea transportation offer more cost-effective options for transporting bulky goods over long distances. Aviation emissions are one of the causes of climate change. Changing climate conditions can lead to more difficult flight conditions and higher fuel costs. Global crises, such as the COVID-19 pandemic, can have a significant impact on demand for air transportation. [6]

Modern air transportation facilities are undergoing rapid development due to innovations that ensure efficiency and safety. The industry's development prospects are directly linked to environmental sustainability, globalization and technological innovation. The aviation industry must be ready to meet the challenges of the modern world and adapt to new conditions to ensure its continued success. New technologies, eco-friendly solutions and the growing demand for fast and comfortable transportation will contribute to the further development of this important industry. Air cargo transportation plays an important role in the global economy, so further growth in transportation volumes and the introduction of new technologies are expected in the future.

Modern means of air transportation continue to develop at a rapid pace and despite the challenges facing the industry, the future of air transportation looks very promising.

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