

CONTEMPORARY CHALLENGES AND PERSPECTIVES FOR THE DEVELOPMENT OF INTERNATIONAL AVIATION LAW

Abstract: *In the last few decades, aviation law has been shaped by new technologies, digitalization, and evolving security risks. This paper examines contemporary challenges that aviation law is facing, with a special focus on legislation and cybersecurity. The analysis highlights regulatory asymmetries between countries, disputes regarding sovereignty and jurisdiction, and the lack of harmonized rules addressing cyber threats. Methodologically, the paper uses analytical, historical, and inductive–deductive approaches. This paper also reviews the international regulations relevant to these issues and offers recommendations for their amendment to meet current conditions. Therefore, the paper concludes that the existing international legal framework for aviation is not sufficiently adapted to emerging risks and that a proactive and coordinated response by international organizations and states is required, particularly to address cybersecurity threats.*

Keywords: *aviation law, challenges, legislation, cyber security threats, harmonization*

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INTRODUCTION

Civil aviation is one of the industries that is changing very quickly, thanks to the rapid technological progress and the development of digital technologies. Equally rapid changes in aviation law have accompanied the rapid nature of changes in civil aviation. The adoption of the Paris Convention in 1919, with the aim of regulating the principle of sovereignty, took the first step towards international legal regulation of this area. Historically, civil aviation has gone through many challenges, and with each challenge that aviation law has encountered, rapid efforts were made by states to overcome the challenges through international regulation.

The first part of this paper will analyze the historical development of aviation law. The second part will analyze the contemporary challenges that aviation law faces. The third and final part will review the opportunities and perspectives that influence the further development of aviation law and provide recommendations on how the challenges can be successfully overcome and turned into opportunities for development.

1. HISTORICAL CHALLENGES IN THE DEVELOPMENT OF INTERNATIONAL AVIATION LAW

After the First World War, states realized how strategically important their airspace was. During this period, states faced the challenge of how to regulate the principle of sovereignty over their airspace and to what extent. The Paris Convention of 1919 succeeded in establishing international rules for determining and insisting on respect for the principle of sovereignty. The principle of sovereignty emphasized the importance of national control of flights and, given the post-war period, states insisted on protecting their airspace. According to this Convention, all over flights or landings of foreign aircraft must have the consent of the home state. Meanwhile, the number of international flights increased, the airline industry became more complex, and the established rules of sovereignty became insufficient and created greater uncertainty. States, members of the international community, began to look for a more flexible solution that would simultaneously protect national interests and enable the smooth operation of air traffic. This challenge was overcome by the adoption of the Chicago Convention in 1944, which is the basic normative document for civil aviation. This convention established the International Civil Aviation Organization (ICAO), as an agency of the United Nations. This agency ensures that all prerequisites for the smooth operation of air traffic are met. The challenge with the principle of sovereignty was overcome by retaining it in the convention as a fundamental one, but with certain concessions that were made in the name of international cooperation. After the adoption

of the Chicago Convention, several other challenges followed aviation law, specific to the time in which they emerged. Thus, the Geneva Convention was adopted, which for the first time regulated the right of ownership and mortgage in the aviation industry. Then the Warsaw Convention, the Hague Protocol and the Montreal Convention were adopted, which regulated the liability of the carrier and the rights of passengers. The Tokyo Convention of 1963 regulates the safety of air traffic, especially protection against criminal acts such as hijacking, sabotage, etc.

The historical development of the challenges shows us that aviation law is not a static category, and throughout history, it has faced many challenges, to which, depending on the era, states have managed to respond and present them in international documents successfully.

2. CONTEMPORARY CHALLENGES OF AVIATION LAW

2.1. Challenges regarding the Legislation

The first contemporary challenge that aviation law is facing is the rapid development of technology and the inability of law in all segments to keep up with the rapid technology change. Namely, the development of digital technologies, drones, and artificial intelligence pose challenges in the functioning of the aviation industry and continuously open new questions to which the existing international legal regulation does not have the answer. Today's aviation systems are dependent on digital technologies; i.e. aviation systems use digital technologies to control passenger lists, baggage, and communications on the plane. This dependence on digital technologies makes the aviation system susceptible to the risk of external abuse, i.e. cyber attacks. In this sense, the law shall regulate the use of digital technologies and provide rules to protect the aviation system as a whole. Next challenge for the aviation law is the non-uniformity of national legislative. Air traffic takes place across national borders, affects the sovereignty of several different countries and carries passengers of different nationalities. The Chicago Convention recognizes the principle of sovereignty as the right of each signatory state to exclusive sovereignty over its airspace. This means that each state has the right to protect its national interest and to apply its national law within its territory. The result is a disparity of national legislations, which is understandable given that the legal system of a country is formed in accordance with the cultural ideologies of that state. The lack of uniformity of national systems creates problems in determining jurisdiction, slowing down the process of resolving disputes and creating legal uncertainty among interested parties.¹ Although the adopted international

¹ Akime, L. E. (2025): "Jurisdictional challenges in aircraft security: Legal gaps and emerging threats in international aviation", *International Journal of Science and Research (IJSR)*, 14(6),

documents tried to mitigate this problem, aviation law still relies to a large extent on national legislation.

A particular challenge facing aviation law is the legal gap in international law regarding the priority of states in asserting their right to jurisdiction. International regulation, and in particular the Tokyo Convention, has failed to regulate the issue of the primacy of the right to jurisdiction in cases where several states express an interest in pursuing a dispute over a committed crime. The Tokyo Convention provides several possible options for the basis for asserting jurisdiction, but does not determine which state would have priority. This situation may lead to several states seeking to pursue the procedure in order to protect their interest in the event that the committed crime was committed against that state.² This challenge has the consequence of prolonging legal disputes and legal uncertainty, while at the same time increase the risk of political conflicts. Another challenge related to determining jurisdiction is determining the place where the crime occurred. When it comes to international flights, given the speed at which the aircraft moves, a situation may arise when the aircraft changes several countries in a short time. The Tokyo Convention establishes that in the event of a crime occurring on board on aircraft, the State whose flag the aircraft flies may be competent. However, this does not exclude the jurisdiction on whose territory the crime was committed. The difficulty arises when the aircraft changes several foreign territories in a short time, and it cannot be determined with certainty on which territory the crime was committed.³

2.2. Challenges regarding the security

Since the establishment of the aviation industry, security protection has remained the biggest challenge. The development of digital technologies in modern times brings many risks to the security of the aviation industry. Cyberspace has become a suitable environment for different attacks and different types of criminal activities.⁴ At the international and regional levels, numerous conventions, standards, and various types of documents are adopted to regulate and protect the aviation industry. In this paper, the focus will be on the protection against cyber attacks, the threat of terrorism, the emergence of new technologies, such as drones, and the protection of personal data used in the digitalized system.

p.339-346.

² Buxbaum, L. (2009): "Territory, Territoriality, and the Resolution of Jurisdictional Conflict", *The American Journal of Comparative Law*, 57(3), pp. 631-675.

³ Razmetaeva, Y., Ponomarova, H., & Bylya-Sabadash, I. (2021): "Jurisdictional issues in the digital age", *Ius Humani: Law Journal*, 10(1), p.168-195.

⁴ Baltezarević, I., & Baltezarević, R. (2021): "Sajber bezbednost: izgradnja digitalnog poverenja", *Megatrend revija*, 18(4), p. 269-280.

Unmanned aircraft systems, commonly known as drones, pose a serious risk to air traffic safety. The greatest security risk is the use of drones for numerous malicious purposes. Namely, drones can be used to collect information, violate the principle of sovereignty, harm the aviation system, carry explosives that can be activated in the vicinity of the aircraft, etc. The usage of drones in some countries is regulated by national legislation. As for the international level, the Chicago Convention in Article 8, which stipulates that permission must be obtained to operate an unmanned aircraft on the territory of another country, has laid the foundation for regulating this issue.⁵ Unfortunately, after the adoption of the Chicago Convention, no international documents have been proposed that would provide a comprehensive framework regulating the issues of the use of unmanned aircraft systems.

The aviation industry, due to its specificity, is susceptible to many cyber-attacks, which are becoming more modern and sophisticated. Cyber threats mostly affect aircraft systems. Ransomware is extremely dangerous for the aviation industry, and in general, for any industry whose data and communication depend completely on digital technologies. Specifically, malicious hackers can disrupt flight control operations or misuse sensitive information. Besides ransom wares, GPS spoofing and modifying the navigation configuration by malicious persons are the most frequently used cyber-attacks in the aviation industry. It is reported that the use of these attacks in increased by 400% in the last ten years.⁶ The next challenge that aviation law is facing is regarding cyber terrorism. In the literature, cyber terrorism is defined as politically motivated attacks on aviation's digitalized systems, directed towards the people or the state.⁷ The existing regulations are related to conventional forms of terrorism, but that regulations cannot be applied to cyber terrorism.⁸ Even though cyber terrorism is a tactic of conventional terrorism, it is rational to conclude that on this kind of terrorism cannot be applied the same rules as for conventional terrorism, because cyber terrorism is manifested in cyberspace.⁹ On the other hand, international documents related to aviation law do not contain specific rules relating to cyber terrorism, only rules regarding endangering flight safety.

⁵ Rodgers, M. W., & Otieno, N. (2021): "International aviation law response to security in relation to unmanned aircraft system: A case for effective regulations", *The Aviation & Space Journal*, 21(3), p.1-18.

⁶ Stastny, P. and Stoica, A.M. (2022): "February. Protecting aviation safety against cybersecurity threats", In: *IOP Conference Series: Materials Science and Engineering*, 1226(1), 012025

⁷ Scott Schober: "Cyber Terrorism - The Weapon of Choice a Decade after 9/11", *Homeland Sec. News Wire*.

⁸ Feldman, D. K.-D., & Gross, E. (2020): "Cyber terrorism and civil aviation: Threats, standards and regulations", *Florida State University Journal of Transnational Law & Policy*, 29(1), 131-167.

⁹ Klisarić, S. (2021): "Sajber terorizam kao okidač sve intenzivnije potrebe za bezbednost sistema od opasnosti koja dolazi sa interneta", *Megatrend revija*, 18(2), 247-256.

3. PERSPECTIVES FOR FUTURE DEVELOPMENT OF INTERNATIONAL AVIATION LAW

The perspectives for further development of international civil aviation law consist of insisting on a higher degree of harmonization of national legislation with international regulations, adapting international rules to new technological advances, and greater commitment and systematic regulation of cyber threats and cyber crimes. As concluded above, aviation law is based to a large extent on national legislation. In this sense, the international community and international aviation organizations should insist on the harmonization of national laws with international regulations by incorporating the provisions of international documents and standards adopted by international organizations into domestic legislation, with minimal variations by national authorities. In this way, states provide a harmonized framework that facilitates international air traffic. Furthermore, it is necessary to specify in detail the provisions of the Tokyo Convention relating to the determination of jurisdiction. Considering that the manner in which the invocation of jurisdiction is determined creates additional misunderstandings and prolongs disputes, it is essential to overcome this challenge. In terms of overcoming the challenges associated with cyber threats, international regulation must move beyond the current technologically neutral narrative and actively incorporate new technological advances and concepts into regulation. For example, a comprehensive legal framework for unmanned technologies may be necessary, given the risks posed to aviation. Criminalization of cyber-related offenses is also needed to provide adequate protection against cyber threats. This step must be carried out with the utmost care, due to the specific character of the cyber-attacks. Rapid technological change makes it difficult to follow the cyber threats and attacks, which are becoming more complex.¹⁰ At the same time, cyber-attacks are increasing because the aviation industry is becoming more dependent on digital technology.¹¹ It is recommended that all contemporary cyber threats for the aviation industry become a part of an international treaty, which should also contain minimum measures of prevention of cyber-attacks.¹² Furthermore, the establishment of an international authority with a main role of receiving and processing the threats that countries report is of great importance.

¹⁰ Atrey, I. (2024): "Cybercrime and its Legal Implications: Analysing the challenges and Legal frameworks surrounding Cybercrime, including issues related to Jurisdiction, Privacy, and Digital Evidence", *International Journal of Research and Analytical Reviews*, 10(3), 1-15.

¹¹ Kožović, D.V., Đurđević, D.Ž. (2019): "Sajber bezbednost u avijaciji", *Megatrend revija*, 16(2), str. 39-56.

¹² Feldman, D. K., D., & Gross, E. (2020): "Cyber terrorism and civil aviation: Threats, standards and regulations", *Florida State University Journal of Transnational Law & Policy*, 29(1), 131-167.

CONCLUSION

The analysis shows that the international legal framework of aviation is not sufficiently adapted to the accelerated digitalization and growing cybersecurity risks. Furthermore, international law has not yet found a solution for determining the primacy of jurisdiction in the event that several states claim to have jurisdiction in a given case. The most prominent problems are regulatory asymmetries between states, inconsistent interpretations of jurisdiction in cross-border incidents, and the lack of harmonized rules regarding unmanned technologies and new types of cyber attacks. The consequences of these problems are legal uncertainty, increased costs of harmonization, and potential gaps in the protection of flight safety and continuity of operations. In this sense, a proactive and coordinated response of international organizations and states is needed. The incrimination of crimes related to cyber offenses, the amendment of existing international documents, and the adoption of new comprehensive international documents are proposed. Furthermore, the establishment of an international body by states to analyse and process cyber threats and attacks is also proposed.

LITERATURE

- Akime, L. E. (2025): "Jurisdictional challenges in aircraft security: Legal gaps and emerging threats in international aviation", *International Journal of Science and Research (IJSR)*, 14(6), p.339-346.
- Atrey, I. (2024): "Cybercrime and its Legal Implications: Analysing the challenges and Legal frameworks surrounding Cybercrime, including issues related to Jurisdiction, Privacy, and Digital Evidence", *International Journal of Research and Analytical Reviews*, 10(3), 1-15.
- Baltezarević, I., & Baltezarević, R. (2021): "Sajber bezbednost: Izgradnja digitalnog poverenja", *Megatrend revija*, 18(4), p. 269–280.
- Buxbaum, L. (2009): "Territory, Territoriality, and the Resolution of Jurisdictional Conflict", *The American Journal of Comparative Law*, 57(3), pp. 631-675.
- Feldman, D. K., D., & Gross, E. (2020): "Cyber terrorism and civil aviation: Threats, standards and regulations", *Florida State University Journal of Transnational Law & Policy*, 29(1), 131–167.
- Feldman, D. K.-D., & Gross, E. (2020): "Cyber terrorism and civil aviation: Threats, standards and regulations", *Florida State University Journal of Transnational Law & Policy*, 29(1), 131–167.

- Klisarić, S. (2021): “Sajber terorizam kao okidač sve intenzivnije potrebe za bezbednost sistema od opasnosti koja dolazi sa interneta”, *Megatrend revija*, 18(2), 247–256.
- Kožović, D.V., Đurđević, D.Ž. (2019): “Sajber bezbednost u avijaciji”, *Megatrend revija*, 16(2), str. 39-56.
- Razmetaeva, Y., Ponomarova, H., & Bylya-Sabadash, I. (2021): “Jurisdictional issues in the digital age”, *Ius Humani: Law Journal*, 10(1), p.168–195.
- Rodgers, M. W., & Otieno, N. (2021): “International aviation law response to security in relation to unmanned aircraft system: A case for effective regulations”, *The Aviation & Space Journal*, 21(3), p.1-18.
- Scott Schober: “Cyber Terrorism - The Weapon of Choice a Decade after 9/11”, *Homeland Security, News Wire*.
- Stastny, P. and Stoica, A.M. (2022): “February. Protecting aviation safety against cybersecurity threats”, In *IOP Conference Series: Materials Science and Engineering*, 1226(1), 012025.

SAVREMENI IZAZOVI I PERSPEKTIVE RAZVOJA MEĐUNARODNOG VAZDUHOPLOVNOG PRAVA

Apstrakt: Tokom poslednjih decenija vazduhoplovno pravo oblikovali su razvoj novih tehnologija, digitalizacija i promenljivi bezbednosni rizici. Ovaj rad razmatra savremene izazove, s posebnim fokusom na zakonodavne izazove i izazove povezane sa sajber-bezbednošću. Analiza ukazuje na regulatorne asimetrije među državama, sporna pitanja suvereniteta i nadležnosti, kao i na nepostojanje usklađenih pravila koja uređuju sajber pretnje. Metodološki, rad se oslanja na analitički, istorijski i induktivno-deduktivni pristup. Takođe se preispituju relevantni međunarodni pravni instrumenti i propisi, uz davanje preporuka za njihovu izmenu i dopunu radi prilagođavanja savremenim uslovima. Zaključuje se da postojeći međunarodni pravni okvir vazduhoplovnog prava nije dovoljno prilagođen novim izazovima, te da je potreban proaktivan i koordinisan pristup međunarodnih organizacija i država, naročito u pogledu suzbijanja sajber-bezbednosnih pretnji.

Ključne reči: vazduhoplovno pravo, izazovi, zakonodavstvo, sajber-bezbednosne pretnje, harmonizacija