

Hobe / Heile / Crüwell

Aviation Law



Hobe / Heile / Crüwell
Aviation Law

Aviation Law

by

Stephan Hobe
Moritz Heile
Carl Crüwell

2026



Published by

Nomos Verlagsgesellschaft mbH & Co. KG, Waldseestraße 3-5, 76530 Baden-Baden, Germany,
email: service@nomos.de

Co-published by

Verlag C.H.Beck GmbH & Co. KG, Wilhelmstraße 9, 80801 München, Germany,
email: bestellung@beck.de

and

Hart Publishing, Kemp House, Chawley Park, Cumnor Hill, Oxford, OX2 9PH, United Kingdom,
online at: www.hartpub.co.uk

Published in North America by Hart Publishing,
An Imprint of Bloomsbury Publishing 1385 Broadway, New York, NY 10018, USA
email: mail@hartpub.co.uk

ISBN 978 3 7560 1069 1 (NOMOS Print)

ISBN 978 3 7489 4181 1 (NOMOS ePDF)

ISBN 978 3 406 82567 5 (C.H.BECK)

ISBN 978 1 5099 5716 3 (HART)

First Edition 2026

© Nomos Verlagsgesellschaft mbH & Co. KG, Baden-Baden 2026. Overall responsibility for
manufacturing (printing and production) lies with Nomos Verlagsgesellschaft mbH & Co. KG.

This work is subject to copyright. All rights are reserved, whether the whole or part of the
material is concerned, specifically those of translation, reprinting, re-use of illustrations,
broadcasting, reproduction by photocopying machine or similar means, and storage in data
banks. Under § 54 of the German Copyright Law where copies are made for other than private
use a fee is payable to »Verwertungsgesellschaft Wort«, Munich, Germany.

Foreword

The history of aviation is as dynamic as it is compelling. What began with the daring ambition of early pioneers quickly became shaped by the strategic imperatives of warfare, eventually maturing into a global commercial industry that now links even the most remote regions of the planet. Yet the vulnerability of this intricate system was laid bare by a recent global pandemic, which brought about an unprecedented disruption: virtually overnight, air travel came to a halt. Passenger aircraft, once ubiquitous in the skies, became a rare sight. Departure boards at airports stood empty, bustling terminals fell silent, and space to accommodate grounded aircraft became scarce.

The consequences for passenger aviation were profound. Numerous airlines ceased operations altogether, while others battled to survive – turning to investors, restructuring financially, or relying on government intervention. In contrast, air cargo assumed a new level of importance, ensuring the continuity of global trade and supply chains. Passenger aircraft were rapidly converted for freight use, giving rise to the term “preighter” – a hybrid of “passenger” and “freighter.” Concurrently, private and corporate aviation experienced a surge in demand, as travellers sought alternatives to constrained commercial services.

Beyond these immediate developments, the aviation sector is undergoing a far-reaching transformation. Innovative business models are emerging, such as autonomous air taxis, commercial drones, and virtual airlines. At the same time, the industry faces mounting scrutiny over its environmental impact, widely recognized as a significant contributor to climate change. Governments and international institutions have responded with a range of regulatory measures – emissions trading schemes, fuel efficiency standards, and restrictions on short-haul flights among them. Yet these challenges are paralleled by new opportunities, propelled by technological innovation, digital transformation, and a continued global fascination with flight.

This book offers a thorough and current overview of Aviation Law, capturing the most recent trends in legislation, regulation, and case law. More than a century after its birth, aviation is now governed by a complex and far-reaching legal framework that deeply influences operational practices. Few sectors are as extensively regulated. To guide readers through this intricate landscape, the book explores key legal questions and challenges in aviation, moving beyond conventional legal categories. It is designed both as an accessible introduction to the subject and as a practical reference for professionals in the field, including lawyers, in-house counsel, judges, and regulators.

This work is informed by extensive academic teaching, research, and practical legal experience. The authors warmly welcome feedback and insights from readers to help shape future editions.

Cologne/Berlin in the winter 2025/2026

Stephan Hobe

Moritz Heile

Carl Crüwell

CONTENTS

Foreword	V
List of abbreviations	XV

CHAPTER 1 DEVELOPMENT OF AIR TRAFFIC

1. From Icarus to Leonardo	1
2. The Beginning of Ballooning	2
3. Aviation Pioneers	2
4. Impact of two World Wars	3
5. The Rise of Civil Aviation	4
6. Liberalization and Deregulation of Global Air Transport	5
7. The COVID-19 Pandemic	6
8. Air Transport in Today's World	7
9. Current Challenges	9
10. Trends and Developments	10

CHAPTER 2 AVIATION LAW AND POLICY

1. Aviation Law as a (unique) Legal Discipline	12
1.1 Private and Public Aviation Law	12
1.1.1 Private Aviation Law	13
1.1.2 Public Aviation Law	13
1.2 National and International Aviation Law	13
1.2.1 National Aviation Law	13
1.2.2 International Aviation Law	14
2. Aviation Law as an Instrument of Aviation Policy	15
2.1 Flight and Operational Safety	15
2.2 National Security and Defense	17
2.3 Economic and Industrial Policy	18
2.4 Transportation and Infrastructure Policy	19
2.5 Other Policies	20
3. Aviation Law and its Policies	21

CHAPTER 3 SOURCES OF AVIATION LAW

1. The Inherently International Nature of Aviation Law	23
2. Selected Sources of Public and Private International Aviation Law	24
2.1 Subjects of International Law	24
2.2 Effect of Public International Law on the National System	25
2.3 Sources of International Law	25
2.4 Interpretation of International Treaties	26
2.5 Public International Law and Private International Law	27
3. European Union Law	27
4. The Function of National Laws	28
5. Rules from Public and Private International Organizations	29
5.1 International Civil Aviation Organization	29
5.2 European Union Aviation Safety Agency	30
5.3 International Air Transport Association	31

Contents

CHAPTER 4 CHICAGO CONVENTION AND ICAO

1.	Pre-Chicago Developments	32
1.1	Paris Conference (1910)	33
1.2	The Paris Air Transport Agreement (1919)	33
1.3	The Madrid Convention (1926)	34
1.4	The Pan-American Agreement (1928)	35
2.	The Chicago Conference (1944)	35
2.1	The Eve of the Conference	35
2.2	The Course of the Conference	36
2.2.1	The United States	37
2.2.2	The United Kingdom	38
2.2.3	Other States	38
3.	The Chicago Convention (1944)	39
3.1	Air Sovereignty	40
3.2	Scope of Application	41
3.2.1	Aviation	42
3.2.2	Civil Aviation	42
3.2.3	International Civil Aviation	43
3.3	Misuse of Civil Aviation	43
3.4	Use of Weapons against Aircraft	44
4.	International Civil Aviation Organization	44
4.1	The Assembly	45
4.2	The Council	46
4.3	The Secretariat	46
4.4	The Air Navigation Committee	47
5.	Annexes to the Chicago Convention	47
5.1	Standards	48
5.2	Recommended Practices	48
5.3	Legal Status of SARP	48
6.	Criticisms and Reform Perspectives	49

CHAPTER 5 OPERATION OF INTERNATIONAL AIR TRANSPORT SERVICES

1.	International Air Transportation	50
1.1	Scheduled International Air Services	50
1.2	Non-Scheduled International Air Services	52
2.	Cabotage	53
3.	Nationality of Aircraft	54
4.	Prohibited Areas	55
5.	Freedoms of the Air	56
5.1	The Transit Agreement (1944)	57
5.2	The Transport Agreement (1944)	58
5.2.1	Five Freedoms of the Air	58
5.2.2	Beyond the Five Freedoms of the Air	59

CHAPTER 6 AIR SERVICES AGREEMENTS

1.	Legal Status of Air Services Agreements	61
2.	Principles of Air Services Agreements	62
2.1	Bilaterality	62
2.2	Reciprocity	62
2.3	Fair and Equal Opportunity	63
3.	The EU Single Aviation Market	63
3.1	Internal Market	63
3.2	External EU Aviation Relations	64
3.1.1	CJEU "Open Skies" Judgments	64
3.1.2	Implementation of the "Open Skies" Judgments	64

Contents

4.	Types of Air Services Agreements	65
4.1	The Chicago Template	65
4.2	Bermuda I Agreement	66
4.3	Bermuda II Agreement	66
4.4	Liberal Air Services Agreements	67
4.4.1	Open Skies: First Generation	67
4.4.2	Open Skies: Second Generation	68
4.4.2.1	US-Netherlands Agreement (1992)	68
4.4.2.2	EU-US Air Services Agreement (2007)	68
5.	Structure of Air Services Agreements	68
6.	Typical Elements of Air Services Agreements	69
6.1	Traffic Rights	69
6.2	Route Schedules	70
6.3	The Designation Requirement	71
6.3.1	Single Designation	71
6.3.2	Double Designation	72
6.3.3	Multiple Designation	72
6.4	Ownership and Control	72
6.4.1	External Element	74
6.4.1.1	Substantial Ownership	74
6.4.1.2	Effective Control	75
6.4.2	Internal Element	75
6.4.2.1	European Union	75
6.4.2.2	United States	76
6.4.2.3	State Practice	77
6.5	Capacity and Frequencies	77
6.5.1	Predetermination (ex ante)	77
6.5.2	Bermuda I (Ex Post Review)	78
6.5.3	Free Determination	78
6.6	Tariff Setting	78
6.6.1	Development	78
6.6.2	Tariff Approval	79
6.6.2.1	Double Approval	79
6.6.2.2	Country of Origin Approval/Disapproval	80
6.6.2.3	Double Disapproval	80
6.6.2.4	Free Pricing	80

CHAPTER 7 AVIATION SAFETY

1.	ICAO Framework	82
1.1	Annex 1: Personnel Licensing	84
1.2	Annex 2: Rules of the Air	85
1.3	Annex 6: Operation of Aircraft	85
1.4	Annex 8: Airworthiness of Aircraft	86
1.5	Annex 19: Safety Management	87
2.	International Cooperation	88
3.	IATA	89
4.	European Law	89

CHAPTER 8 AVIATION SECURITY

1.	Aviation Security in International Law	92
2.	Annex 17: Security	93
3.	Security in Civil Aviation	94
3.1	Operation	94
3.2	Appendix to Annex 17	95
3.3	Implementation	95
4.	Additional Multilateral Treaties	96
5.	Air Services Agreements	97

Contents

6. Other State Treaties	97
7. Further Stakeholders	98

CHAPTER 9
AIRCRAFT IN DISTRESS AND AVIATION ACCIDENT INVESTIGATIONS

1. Aircraft in Distress	100
1.1 Early International Law	100
1.2 Chicago Convention (1944)	100
1.3 Annex 12	101
1.3.1 Search and Rescue Services	101
1.3.2 Cooperation	102
1.3.3 Emergency Situations	102
1.4 Appendix to Annex 12	102
1.5 ICAO: Call for Cooperation	103
1.6 Implementation	103
2. Aircraft Accident and Incident Investigation	103
2.1 Chicago Convention (1944)	104
2.2 Annex 13	104
2.2.1 Objectives	105
2.2.2 Scope	105
2.2.3 Responsibilities	106
2.2.4 Reporting	107
2.3 Annex 9	108
2.4 Implementation	108

CHAPTER 10
OPERATION OF UNMANNED AIRCRAFT SYSTEMS

1. International Regulation of UAS	111
1.1 Article 8 Chicago Convention	111
1.2 Soft Law	111
1.3 Adaptation of Annexes	112
2. Regional Regulation of UAS	113
2.1 Basic Regulation (EU) 2018/1139	113
2.2 Implementing Regulation (EU) 2019/947	114
2.2.1 Open Category	114
2.2.2 Specific Category	115
2.2.3 Certified Category	116
2.3 Delegated Regulation (EU) 2019/945	116

CHAPTER 11
AIRCRAFT

1. Rights in Aircraft	118
1.1 Ownership	119
1.2 Special Case: Engines	119
1.3 Possession without Ownership: Leasing	120
1.3.1 Dry Leasing	120
1.3.2 Wet Leasing	121
1.3.3 Regulatory Supervision	121
1.4 Security Interests in Aircraft	122
1.4.1 Geneva Convention (1948)	122
1.4.2 Cape Town Convention and Aircraft Equipment Protocol	123
1.4.2.1 International Interest	124
1.4.2.2 International Registry and Priority	124
1.4.2.3 Default Remedies	125
2. Sale and Purchase of Aircraft	125
2.1 Contract Basics	125
2.2 Common Clauses	126
2.3 Inspection and Delivery of Aircraft	127

Contents

3.	International Aircraft Financing and Leasing	127
3.1	Finance Leasing	127
3.2	Sale and Lease Back	128
4.	Airworthiness	128
4.1	Type Certification	129
4.2	Initial Airworthiness	130
4.3	Continuing Airworthiness	130
4.3.1	States	131
4.3.2	Air Operator	131
4.3.3	Design Organization and Manufacturer	132

CHAPTER 12
OPERATION OF AIRPORTS

1.	Safety Regulation	134
2.	Security Regulation	135
3.	Economic Considerations	135
3.1	Ownership and Operation	136
3.1.1	Publicly Owned and Operated Airports	136
3.1.2	Public Ownership with Private Operational Involvement	137
3.1.2.1	Management Contract	137
3.1.2.2	Concession	137
3.1.3	Privately Owned and Operated Airports	138
3.2	Airport Revenues	138
3.3	Airport Coordination and Slots	139

CHAPTER 13
AIR CARRIER LIABILITY

1.	The Warsaw System	143
1.1	The Warsaw Convention (1929)	143
1.2	Amendments to the Warsaw Convention (1929)	144
1.2.1	Hague Protocol (1955)	144
1.2.2	Guadalajara Convention (1961)	144
1.2.3	Montreal Intercarrier Agreement (1966)	145
1.2.4	Guatemala City Protocol (1971)	145
1.2.5	Montreal Protocols No. 1-4 (1975)	145
1.2.6	IATA Intercarrier Agreement (1995)	146
2.	The Montreal Convention (1999)	146
2.1	Scope and Applicability	147
2.2	Air Carrier Liability: Basis of Claim	149
2.2.1	Passenger Injury or Death	149
2.2.1.1	Death or Bodily Injury	149
2.2.1.2	Accident Causing Damage	150
2.2.1.3	Liability Period	151
2.2.1.4	Legal Consequence	151
2.2.2	Damage to Baggage	151
2.2.3	Damage to Cargo	152
2.2.4	Delay of Passengers, Baggage, or Cargo	153
2.3	Limits of Liability: Passenger Injury or Death	154
2.3.1	Strict Liability	154
2.3.2	Unlimited Liability	154
2.4	Limits of Liability: Cargo, Baggage and Delay	155
2.5	Special Drawing Rights and Revision of Limits	155
2.6	Contributory Fault	156
2.7	Recoverable Damages	156
2.8	Jurisdiction	156
2.8.1	The Domicile of the Carrier	157
2.8.2	The Principal Place of Business of the Carrier	157
2.8.3	The Place Where the Carrier Has a Place of Business Through Which the Contract Has Been Made	158

Contents

2.8.4	The Place of Destination	159
2.8.5	Fifth Forum: Principal and Permanent Residence of the Passenger	159
2.9	Limitation of Actions	160
2.10	Rules on the Contract of Carriage	160
2.11	Exclusivity Principle	161
2.12	Other Defendants	161
3.	Third Party and Surface Damage Liability	163
3.1	Rome Convention (1933)	163
3.1.1	Strict Liability Regime	163
3.1.2	Liability Limits Based on Aircraft Weight	164
3.1.3	Grounds for Exoneration	164
3.1.4	Surface-Only Scope	164
3.1.5	In-Flight Damage	164
3.1.6	Ratification and Effect	164
3.2	Rome Convention (1952)	164
3.3	Further Attempts	165
4.	Product Liability	166
4.1	Strict Liability	166
4.2	Compensation	166

CHAPTER 14 AIR PASSENGER RIGHTS

1.	Air Passenger Rights in Europe	168
2.	The European Air Passenger Regulation	169
3.	Applicability of the European Air Passenger Regulation	169
3.1	Territorial Scope	169
3.2	Personal Scope	171
4.	Causes of Action under the Air Passenger Regulation	171
4.1	Denied Boarding, Art. 4	172
4.1.1	Right to Compensation, Art. 7	172
4.1.2	Right to Reimbursement and Re-Routing, Art. 8	173
4.1.3	Right to Care, Art. 9	174
4.2	Cancellation, Art. 5	174
4.2.1	Exemption from Compensation, Art. 5 (1) (c)	174
4.2.2	Extraordinary Defence for the Air Carrier, Art. 5 (3)	175
4.3	Delays, Art. 6	176
4.4	Delays vs. Cancellations	176
4.5	Upgrading and Downgrading	177
5.	Special Provisions, Supplementary Remedies, and Enforcement	178
6.	European Passenger Rights and the Montreal Convention (1999)	178
7.	Status of the European Air Passenger Regulation	179
8.	Other Jurisdictions	180

CHAPTER 15 CRIMINAL AVIATION LAW

1.	The International Regime for Criminal Aviation Law	183
1.1	The Tokyo Convention (1963) as amended by the Montreal Protocol (2014)	183
1.1.1	Scope of Application	183
1.1.1.1	Action-Related Element	184
1.1.1.2	Situation of Transport	184
1.1.1.3	Territorial Scope	185
1.1.1.4	Exclusion	186
1.1.2	Substantive Content	186
1.1.2.1	Jurisdiction	186
1.1.2.2	Unlawful Seizure	186
1.1.2.3	The Powers and Duties of States	187
1.2	The Hague Hijacking Convention (1970)	187
1.2.1	Scope of Application	187
1.2.1.1	Situation of Transport	187

Contents

	1.2.1.2	Territorial Element	187
	1.2.1.3	Exclusion	188
	1.2.2	Substantive Content	188
	1.2.3	The Beijing Supplementary Protocol (2010)	189
1.3		The Beijing Convention (2010)	189
	1.3.1	Scope of Application	190
	1.3.1.1	Acts Relating to Aircraft	190
	1.3.1.2	Acts Against Air Navigation Facilities	190
	1.3.1.3	Acts at Airports	190
	1.3.1.4	Exclusion	191
	1.3.2	Substantive Content	191
	1.3.2.1	Prohibited Offences	191
	1.3.2.2	Procedural Regulation	192
	1.3.2.3	Preventative Regulation	192
2.		The Special Role of the Aircraft Commander	192
	2.1	The Aircraft Commander	192
	2.1.1	Requirements	192
	2.1.2	Authorization	193
	2.2	Other Persons	194
	2.3	Immunity from Legal Consequences	194
3.		The Special Case of Unruly Passengers	194

CHAPTER 16 CYBER THREATS AND CYBERSECURITY

1.	Vulnerabilities	196
2.	Regulatory Challenges	196
3.	International Legal Framework	197
	3.1 Annex 17	197
	3.2 ICAO Assembly Resolutions	198
4.	Beijing Convention (2010)	198
5.	National Legislation	199
6.	Outlook and Perspective	200

CHAPTER 17 MILITARY AVIATION

1.	Aviation Law and Military Operations during Peacetime	201
	1.1 Operations	202
	1.2 Special Peacetime Operations: Interception, Inspection and Diversion	202
	1.3 Airspace	203
	1.3.1 International Airspace	203
	1.3.2 National Airspace	203
	1.3.3 Special Zones	204
	1.4 Military Aircraft	205
2.	Aviation Law and Military Operations in Warfare	206
	2.1 The Law of Armed Conflict	206
	2.2 Airspace	207
	2.2.1 Warning Zones	207
	2.2.2 No Fly Zones	208
	2.2.3 Exclusion Zones	208
	2.2.4 Aerial Blockade	208

CHAPTER 18 AVIATION, CLIMATE AND THE ENVIRONMENT

1.	The Protection of the Environment under Public International Law	210
	1.1 United Nations Framework Convention on Climate Change	211
	1.1.1 The Framework	212
	1.1.2 Substantive Obligations	212
	1.1.3 Inclusion of Aviation	213

Contents

1.2	The Kyoto Protocol (1997)	213
1.2.1	Aviation in the Kyoto Protocol	214
1.2.2	Constraints of the Kyoto Protocol	214
1.3	Paris Agreement (2015)	215
1.4	The Framework's Success	215
2.	The Protection of the Environment under International Aviation Law	216
2.1	Goals and Assembly Resolutions	216
2.2	Initiatives, Policies and Practices	217
2.3	Aircraft Technology	218
2.4	Operational Improvements	218
2.5	Sustainable Aviation Fuels	219
2.6	Carbon Offsetting and Reduction Scheme for International Aviation	219
2.6.1	Offsetting as a Measure	220
2.6.2	CORSIA Timeframe and Scope of Application	220
2.6.3	CORSIA Implementation	221
2.7	Constraints and Successes of CORSIA	222
3.	The Protection of the Environment under European Aviation Law	222
3.1	European Union Emissions Trading System	223
3.1.1	Cap and Trade Goal	223
3.1.2	Scope of Application and Aviation	224
3.1.3	Functioning of the EU ETS	224
3.2	ReFuelEU Aviation	225
3.3	Single European Sky	226
4.	Climate Litigation	226

CHAPTER 19 SPACE LAW

1.	Outer Space Regulation	229
1.1	Outer Space Treaty (1967)	229
1.2	Rescue Agreement (1968)	230
1.3	Liability Convention (1972)	231
1.4	Registration Convention (1975)	231
1.5	Moon Agreement (1979)	231
1.6	United Nations General Assembly Resolutions	232
2.	Delimitation of Airspace and Outer Space	232
2.1	Spatialist Approach	233
2.2	Functionalist Approach	233
3.	New Space Perspectives	234
3.1	Space Mining	234
3.2	Space Debris	234
3.3	Space Tourism	235

CHAPTER 20 NAVIGATING THE FUTURE OF AVIATION LAW

1.	Technological Innovations and Legal Adaptation	236
2.	Environmental Sustainability and Climate Change	237
3.	Emerging Legal Issues: Privacy, (Cyber-)Security and Consumer Protection	238
4.	From Paris to Chicago to Montreal and Beyond	239

Index	241
-------------	-----

CHAPTER 1

DEVELOPMENT OF AIR TRAFFIC

“Flight by machines heavier than air is impractical and insignificant, if not utterly impossible.”

Simon Newcomb

Professor of Mathematics and Astronomy at John Hopkins University

Throughout history, few technological advancements have captured the human imagination and transformed global society as profoundly as aviation. From the earliest dreams of flight to the advent of sophisticated modern aircraft and the complex infrastructure of global air traffic systems, the evolution of air transportation is testament to human ingenuity, determination, and innovation. This remarkable progression – from rudimentary gliders to supersonic jets and autonomous drones – has not only revolutionized commerce, communication, and mobility but has also necessitated the development of a robust legal framework to govern its growth. Accordingly, this book begins with a concise yet illuminating overview of the key milestones that have shaped the trajectory of air traffic, setting the stage for a deeper examination of the legal principles that underpin aviation law today.

1. From Icarus to Leonardo

The aspiration to fly has been a defining dream of humankind, tracing back to the earliest civilizations. Even in antiquity, the desire to conquer the skies found expression in mythology, as seen in the account of Icarus and Daedalus recorded by the Roman poet Ovid (43 B.C.-17/18 A.D.). According to Greek legend, Daedalus crafted wings from feathers, fabric threads, and beeswax to escape imprisonment under King Minos. However, his son Icarus, disregarding his father's warnings, flew too close to the sun, causing the wax in his wings to melt. As a result, he plummeted into the sea and drowned.¹ While this myth gave rise to a modern idiom (“flying too close to the sun”), it did little to inspire confidence in the pursuit of flight.

A more constructive contribution to the study of flight came from Leonardo da Vinci (1452–1519), a polymath whose curiosity extended far beyond his celebrated works in painting, sculpture, and engineering. Da Vinci's fascination with aviation is evident in his extensive studies on the mechanics of flight, including his Codex on the Flight of Birds (c. 1505).² His sketches of flying machines, such as the ornithopter and a helical rotor-based device, illustrate his visionary approach to aerodynamics. Although none of his designs were realized in his lifetime, they provided foundational concepts that would later inspire the pioneers of aviation.

¹ Naso, Publius Ovidius, *Metamorphoses*, liber VIII, lines 185–235.

² Richardson, Philip L, “Leonardo da Vinci's discovery of the dynamic soaring by birds in wind shear”, *The Royal Society Journal of the History of Science*, 73 (2019), pp. 285–301.

Chapter 1 Development of Air Traffic

2. The Beginning of Ballooning

- 4 Nearly three centuries would pass before Leonardo da Vinci's vision of flight became a reality. The 18th century marked the dawn of manned flight with the pioneering work of the Montgolfier brothers – Joseph-Michel Montgolfier (1740 – 1810) and Jacques-Étienne Montgolfier (1745 – 1799) – who developed the first hot-air balloons. By the early 1780s, they had conducted extensive experiments with various materials and designs, ultimately discovering that heated air was lighter than the surrounding atmosphere and could generate lift.
- 5 In 1783, their efforts culminated in the successful launch of an unmanned hot-air balloon made of paper and cloth, which ascended to approximately 6,000 feet (1,800 meters) and traveled a significant distance.³ Encouraged by this success, the brothers soon conducted the first “manned” flight – though with unconventional passengers: a sheep, a duck, and a rooster. While still technically unmanned in human terms, the experiment demonstrated that living beings could survive airborne travel.
- 6 Later that year, the Montgolfiers achieved a major milestone by launching the first human-crewed flight. In the late autumn of 1783, a hot-air balloon carrying two passengers ascended to an altitude of roughly 3,000 feet (900 meters) and covered a distance of about 5 miles (9 kilometers).⁴ Interestingly, despite their groundbreaking work, the Montgolfier brothers themselves opted to remain on the ground, allowing others to take their place in history as the first humans to experience controlled flight. Nevertheless, their contributions laid the foundation for the development of ballooning and, more broadly, the evolution of air transportation.

3. Aviation Pioneers

- 7 While the history of ballooning was shaped by two European brothers, two determined and innovative American siblings would lay the foundation for modern aviation by flying the first successful powered aircraft. Orville Wright (1871 – 1948) and Wilbur Wright (1867 – 1912) were originally bicycle mechanics from Ohio, but they shared a fascination with flying. They conducted extensive research and experimentation to understand the principles of flight, including the role of wing shape, control mechanisms, and propulsion. They designed and built their own aircraft, the Wright Flyer, which had a biplane configuration with a wingspan of 40 feet 4 inches (12.3 meters) and a weight of approximately 605 pounds (274 kilograms). On 17 December 1903, near Kitty Hawk, North Carolina, the Wright brothers achieved the first controlled, sustained, powered flight in human history. While Orville piloted the plane, Wilbur ran alongside to help with the take-off. The pleasure was brief, however: The flight covered a distance of 120 feet (37 meters) and lasted only 12 seconds, but it still marked a monumental milestone in the history of aviation.⁵ After their historic flight, the Wright brothers continued to refine their aircraft design and conduct further flights, gradually increasing the duration and distance of their flights. Their pioneering work laid the foundation for future developments in aeronautics and astronautics and continues to influence the design, construction, and operation of aircraft today.

³ El-Sayed, Ahmed F. “History and Evolution of Aircraft: Technological Advancements in Size, Speed, Armaments, and Engines”, Taylor & Francis, 2024, Chapter 1.11.1.

⁴ *Ibid.*

⁵ See for a detailed description of the Wright brothers' invention of the aircraft: Wright, Orville, “How We Invented the Airplane: An Illustrated History”, 1988, Dover Publications Inc.

4. Impact of two World Wars

In Europe, a few years after the Wrights, another aviation pioneer, Frenchman Louis Blériot, made history: Early in the morning of 25 July 1909, he became the first person to cross the English Channel in an airplane. His journey in the single-seater Blériot XI, which he had built himself, from Calais in France to Dover in the United Kingdom took about 30 minutes and is still regarded as mankind's first international flight.⁶ The press on both sides of the Channel was euphoric: "England is no longer an island".⁷ A few months later, on 26 November 1909, the *Deutsche Luftschiffahrts-Aktiengesellschaft* was founded in Frankfurt, Germany. Its purpose was to operate passenger flights using a fleet of Zeppelin airships, and it is generally considered to be the world's first airline. By the time World War I began, the company had not only operated seven passenger Zeppelins but also made 1,588 flights covering 172,355 km (or 107,211 miles) and carrying 33,722 passengers and crew.⁸

4. Impact of two World Wars

During the American Civil War (1861–1864), hot air balloons were first employed for reconnaissance and later to assist ground troops. The military application of aircraft began shortly after the Wright brothers' first flight, notably in the Italo-Turkish War (1911–1912). However, no prior use of aircraft in warfare could compare to the devastating impact of the two world wars, which would dramatically shape the future of aviation.

World War I (1914–1918), or the Great War, was a pivotal moment in history, both for its widespread destruction and the technological advancements it spurred. A significant development during the war was the emergence of aerial combat. At the war's onset, aviation was still in its early stages, with aircraft primarily used for reconnaissance. Slow, fragile biplanes and monoplanes were deployed to gather intelligence on enemy troop movements and positions. These aircraft, typically unarmed, were vulnerable and relied on basic navigation tools. As the war progressed, however, the strategic value of aviation was increasingly recognized. The competition for technological superiority led to rapid advancements in aircraft design, engines, and weaponry. One of the most groundbreaking innovations was the development of synchronized machine guns, which allowed pilots to fire through the spinning propellers without hitting them. This technological leap transformed aerial combat, and dogfights between opposing fighter planes became a defining feature of the war. Legendary figures like the German "Red Baron," Manfred von Richthofen (1892 – 1918), and other famous aces, including American Eddie Rickenbacker (1890–1973) and Frenchman René Fonck (1894 – 1953), captured the public's imagination. These heroes of the sky left an indelible mark on popular culture and influenced both the design of future aircraft and the tactics of aerial warfare.⁹ The war also integrated air support into broader military operations, changing the future of combined arms strategies.

The years following World War I saw significant developments also in commercial aviation. On 8 February 1919, a historic milestone was achieved when 14 passengers

⁶ Skipper, Ben, "100 Years of Civil Aviation: A History from the 1919 Paris Convention to Retiring the Jumbo Jet", 2023, p. 12.

⁷ This quote is sometimes attributed to the British newspaper *Daily Mail*, whose competition Blériot won with his flight. In fact, however, the paper paid surprisingly little attention to the event. However, the quote can be found in the Irish newspaper *The Northern Whig* of 27 July 1909, p. 7.

⁸ Detlef Siegfried, Guillaume de Syon, "Zeppelin! Germany and the Airship, 1900–1939", *The American Historical Review*, Volume 107, Issue 4, October 2002, pp. 1310.

⁹ El-Sayed, Ahmed F., "History and Evolution of Aircraft: Technological Advancements in Size, Speed, Armaments, and Engines", Taylor & Francis, 2024, Chapter 4.5.2.

Chapter 1 Development of Air Traffic

boarded the Farman F60 Goliath, a four-engine biplane, for the first international passenger flight from Toussus-le-Noble, France, to Croydon, England, a distance of 330 kilometers. The Farman F60 Goliath, originally used in the war, was a symbol of aviation's transition from military to civilian use. That same day, Henri and his brother Maurice founded Lignes Farman, which later evolved into Air France. Just days later, on 12 February 1919, the first passenger flight between Paris and Brussels was completed. By 22 March 1919, Lignes Farman initiated its first scheduled air service using a converted French Caudron C.23 bomber. In June 1919, another milestone occurred when British pilots John Alcock and Arthur Whitten Brown completed the first non-stop transatlantic flight, traveling from St. John's, Newfoundland, to Clifden, Ireland, in 16 hours and 27 minutes. Less than a month later, on 2 July 1919, the British airship R34 completed the first transatlantic crossing by airship, reaching Mineola, New York, on July 6. Additionally, the establishment of the International Air Traffic Association in August 1919 laid the foundation for the modern international air transport network. Several airlines, including KLM, Avianca, and Qantas, were founded in 1919 and 1920, though many early carriers were absorbed into larger national airlines. This growing network of scheduled air services began connecting cities and countries around the world.¹⁰

- 12 Despite the outbreak of World War II (1939–1945), which brought a halt to civilian air travel, the war itself spurred significant advancements in aviation. Aircraft technology saw rapid development, with bombers, fighters, reconnaissance planes, and transport aircraft being improved in speed, range, and firepower. Iconic aircraft like the US B-17 Flying Fortress, the British Spitfire, and the German Messerschmitt Bf 109 became symbols of air power, playing a key role in shaping the course of the war.¹¹ The Battle of Britain (1940), in which the British Royal Air Force successfully defended against the German Luftwaffe, became one of the most famous aerial battles in history. Aviation was also crucial in amphibious operations, particularly during the D-Day landings in Normandy (1944), where transport aircraft and gliders were used to deploy paratroopers and supplies.¹² The development of radar systems and improved navigation technologies enhanced reconnaissance and surveillance capabilities, while long-range bombers extended the reach of air strikes. The use of carrier-based aircraft revolutionized naval warfare, and the advent of jet propulsion introduced a new era of faster, more advanced aircraft. The concept of air superiority became a cornerstone of military strategy, as control of the skies was vital to both offensive and defensive operations. The innovations of World War II laid the groundwork for the postwar era and continue to influence modern aviation.

5. The Rise of Civil Aviation

- 13 The end of World War II ushered in a new era for aviation. International collaboration, which had been suspended due to the war, was revived with the formation of organizations like the International Civil Aviation Organization (ICAO) and the International Air Transport Association (IATA), both of which played pivotal roles in

¹⁰ For a detailed review of the early stages of airlines, see: Skipper, Ben, "100 Years of Civil Aviation : A History from the 1919 Paris Convention to Retiring the Jumbo Jet", 2023, Chapter 3.

¹¹ Huston, James A. "Tactical Use of Air Power in World War II: The Army Experience." *Military Affairs*, vol. 14, no. 4, 1950, pp. 166–85. JSTOR, last accessed 22 February 2025, <https://doi.org/10.2307/1982838>.

¹² Overly, Richard, *War in Europe, 1939–1945*, in: Olsen, John Andreas (ed.), *A History of Warfare*, Dulles: Potomac (2009), pp. 30–35.

6. Liberalization and Deregulation of Global Air Transport

advancing commercial aviation. The postwar period was characterized by increased national involvement and regulation in the airline industry. This era saw the rise of state-owned flag carriers, with governments exerting tight control over airline operations by regulating fares, routes, and limiting the number of new airlines entering the market.¹³ While this regulation was intended to maintain safety and stability, it also constrained competition and slowed innovation.

Initially, commercial aviation relied on repurposed military aircraft, but the technological advancements made during the war were quickly adapted for civilian use. The shift from piston engines to jet propulsion marked a significant leap forward, offering unprecedented speed and efficiency. Jet-powered aircraft, such as the British de Havilland Comet and the American Boeing 707, revolutionized long-distance travel and made international flights more accessible. Whereas air travel was once reserved for a select few, it soon became a more common mode of transportation for the masses. The postwar economic boom, mass tourism, the rise of charter flights, the introduction of economy class tickets, and the development of larger, longer-range aircraft all contributed to the expansion of air routes, frequency of flights, and passenger capacity. As a result, the growth of commercial aviation during this time was nothing short of explosive.

Technological advancements continued to shape the industry. Aircraft grew larger, more comfortable, and capable of covering greater distances. The introduction of the Boeing 747, known as the "Queen of the Skies," made air travel more affordable and accessible to a wider population.¹⁴ Airports expanded into international hubs, and the increasing availability of flights made air travel an essential part of global commerce and culture.

Simultaneously, the Cold War rivalry between the United States and the Soviet Union sparked an era of remarkable technological progress and space exploration. The launch of Sputnik in 1957 marked the start of the space race, leading to historic events like Yuri Gagarin's first orbit of Earth in 1961 and the Apollo moon landing in 1969.¹⁵ The space race not only expanded our understanding of the universe but also accelerated innovations in materials science, satellite technology, and human endurance. Closer to Earth, the pursuit of supersonic flight captivated aviation enthusiasts and engineers. Aircraft like the Franco-British Concorde and the Soviet Tupolev Tu-144 demonstrated the feasibility of commercial travel at speeds greater than the speed of sound, further pushing the boundaries of aviation technology.

6. Liberalization and Deregulation of Global Air Transport

For much of its history, civil aviation was governed by complex and extensive economic rules and regulations. These tight regulatory frameworks, designed to protect so-called flag carriers, had a significant impact on the establishment and operation of international air services, influencing airline operations. Few industries were as heavily regulated as the passenger air transport sector. However, this landscape began to shift as governments loosened their grip on the aviation sector, aiming to foster competition and reduce barriers to entry for new market players. The liberalization and deregulation

¹³ Humphreys, Barry, "The Regulation of Air Transport, From Protection to Liberalisation, and Back Again", 2023, p. 11–25.

¹⁴ Skipper, Ben, "100 Years of Civil Aviation: A History from the 1919 Paris Convention to Retiring the Jumbo Jet", 2023, pp. 118–119.

¹⁵ Hobe, *Space Law*, 2nd ed., Baden-Baden: Nomos, 2019, p. 32–33.

Chapter 1 Development of Air Traffic

of civil aviation started in the 1970s and 1980s, when governments worldwide began to relax the stringent controls that had long governed the airline industry.

- 18 The process of deregulation began in the United States with the Airline Deregulation Act of 1978¹⁶, which removed government control over fares and routes, allowing airlines to compete on an equal footing. This opened the doors for increased competition, leading to the entry of new airlines into the market and prompting existing carriers to expand their routes and services. The airline industry underwent a significant transformation during this period, with one of the most notable developments being the rise of low-cost carriers, often referred to as budget or no-frills airlines. Their growth was largely driven by changing consumer demand for more affordable air travel options. By offering lower fares through streamlined operations, focusing on point-to-point routes, and cutting unnecessary costs, these carriers disrupted the market. The increased competition from low-cost airlines forced traditional full-service carriers to adapt their business models, become more cost-efficient, and rethink their approach to air travel. This shift revolutionized the airline industry, with consumers reaping the benefits of more affordable travel and the industry expanding even further.
- 19 As new business models took shape across the globe, advancements in aviation technology further propelled the industry forward, with the digital revolution playing a major role. The introduction of airplanes like the Airbus A320, which featured fly-by-wire systems and glass cockpits, marked a significant leap in commercial aviation. These advanced avionics transformed both the design and operation of aircraft, enhancing safety, efficiency, and passenger comfort, and shaping the modern flying experience.
- 20 While the benefits of liberalization and deregulation were widely praised, concerns about the potential downsides of these policies also emerged. Critics argue that deregulation could lead to lower safety standards, reduced services in rural or less profitable areas, and negative environmental impacts. Despite these concerns, many countries continue to promote liberalization and deregulation as a means of fostering growth, improving efficiency, and ensuring competitiveness in the aviation industry.

7. The COVID-19 Pandemic

- 21 Few industries are as susceptible to external influences and vulnerable to unforeseen shocks as aviation, with factors such as environmental and natural disasters, as well as unpredictable geopolitical events like civil unrest or terrorist attacks, playing significant roles. The aviation sector experienced its most severe crisis in the spring of 2020, when a global pandemic impacted nearly every facet of human life, including air travel. The COVID-19 pandemic brought about challenges, disruptions, and adjustments on an unprecedented scale.
- 22 As the pandemic spread, governments around the world implemented travel restrictions, lockdowns, and quarantine measures in an effort to curb the virus's transmission. These actions resulted in an unprecedented halt to global air travel. Airlines grounded their fleets, airports witnessed dramatic declines in passenger traffic, and international borders were closed. This sudden disruption created a financial crisis for airlines, many of which faced significant losses and an uncertain future. Once a symbol of growth and global connectivity, the airline industry was now grappling with an economic downturn of historic proportions. Revenues plummeted as demand for travel disappeared, leaving airlines struggling to maintain operations under immense financial pressure. Layoffs,

¹⁶ US Airline Deregulation Act, done in Washington D.C., USA, on 24 October 1978.

8. Air Transport in Today's World

furloughs, and pay cuts became common as airlines attempted to weather the storm and survive.¹⁷

In the face of this crisis, however, the airline industry demonstrated remarkable resilience and adaptability. Airlines introduced strict health and safety protocols, including enhanced cleaning procedures, mandatory mask-wearing, and social distancing measures. Innovations like touchless check-in and biometric technology were accelerated to minimize physical contact and ensure the safety of passengers and staff. Cargo operations took on greater significance as passenger aircraft were repurposed to transport critical medical supplies. As vaccination efforts advanced and infection rates began to decline in some regions, airlines cautiously resumed operations, gradually adjusting to a new normal.

Ultimately, the crisis highlighted the aviation sector's resilience, capacity for innovation, and commitment to navigating through unprecedented challenges. As the world emerged from the pandemic, the lessons learned and the changes implemented during this period are expected to shape the future of aviation for years to come.

8. Air Transport in Today's World

Today, air traffic is composed of numerous segments that can be categorized, although any form of categorization inherently lacks a certain degree of selectivity, often leading to overlaps or dependencies between categories.

Commercial aviation refers to the sector of aviation that involves operating aircraft for the transportation of passengers, cargo, or mail for remuneration or hire, typically by air carriers. The group of these air carriers is diverse, varying by their business objectives, service types, aircraft used, and operational scope. Commercial aviation encompasses both scheduled and non-scheduled air transport operations.

Scheduled air carriers are those primarily engaged in providing scheduled air services. As described in the International Civil Aviation Organization (ICAO) Manual on the Regulation of International Air Transport (5.3), scheduled services are typically "open to use by the general public and operated according to a published timetable or with such regularity that it forms an easily recognizable, systematic series of flights." A key characteristic of scheduled air carriers is their maintenance of year-round operations, even during off-season periods with low passenger loads. Their operations typically follow a consistent pattern, and despite the liberalization and deregulation of air transport in recent years, many are still subject to prior government approvals for the points of departure and arrival. A significant portion of these carriers are members of the International Air Transport Association (IATA), a trade organization that now includes carriers beyond those engaged exclusively in scheduled air services.

Within scheduled air carriers, additional sub-categories exist: major air carriers provide scheduled air services on both domestic and international routes, usually with large-scale operations and extensive route networks. Regional carriers operate smaller aircraft, often flying at lower altitudes, on short-haul services along feeder routes or lower-density routes within specific geographic regions. These carriers are sometimes referred to as commuter air carriers, often linking smaller, remote airports to major hubs of larger carriers.

Additionally, the rapid expansion of Low-Cost Carriers (LCCs), or No-Frills Carriers, has been a significant phenomenon. These carriers, a product of the liberalization and

¹⁷ "Economic Impacts of Covid-19 on Civil Aviation", ICAO, Economic Development, accessed 25 June 2025, <https://www.icao.int/sustainability/Pages/Economic-Impacts-of-COVID-19.aspx>

Chapter 1 Development of Air Traffic

deregulation of air transportation markets in many regions, are distinguished from traditional flag or legacy carriers by their typically point-to-point (P2P) operations, reliance on a single type or family of aircraft, and lower cost structures achieved by offering simple or limited in-flight services. Low-cost carriers may operate independently or as subsidiaries of major carriers.

- 30 In contrast to scheduled air carriers, non-scheduled carriers focus on providing air services that are not part of a regular timetable or fixed routes. According to the International Civil Aviation Organization (ICAO) Manual on the Regulation of International Air Transport (5.3), non-scheduled services are defined as “any air service that is performed other than as a scheduled service... including but not limited to charter operations.” These services are often customized and flexible, catering to specific needs or demands. Many non-scheduled carriers operate charter flights, which are typically seasonal or ad-hoc services arranged for specific clients. For example, air carriers may operate a series of flights for tour operators as part of package holidays. These flights do not follow regular schedules and are often tailored to meet demand during peak periods, such as holidays or special events. Other non-scheduled carriers may also specialize in on-demand, short-notice taxi services. These services cater to niche markets, providing air transport for individuals or groups traveling to specific events such as sports matches, company meetings, pilgrimages, or other unique travel needs. Some non-scheduled carriers provide ACMI (Aircraft/Crew/Maintenance/Insurance) services, often in partnership with scheduled carriers. These carriers step in during times of peak demand or when scheduled carriers face operational shortfalls, helping airlines with additional capacity or covering for aircraft maintenance needs. ACMI services are typically short-term arrangements.
- 31 In addition to passenger aviation, cargo air carriers are an essential component of today’s commercial aviation landscape. While early passenger flights also carried goods in the cargo hold (known as belly cargo), many operators now specialize in cargo-only services using dedicated freighters designed exclusively for air freight. Cargo carriers focus on various segments of air freight, offering services such as overnight delivery ensuring rapid delivery of time-sensitive goods, or special deliveries transporting high-value or delicate items, including pharmaceuticals, medical devices, and livestock. Some cargo carriers are subsidiaries of established passenger airlines, providing dedicated air cargo services. Others operate as independent companies focused solely on cargo transport. Over time, the scope of air cargo has expanded beyond the initial focus on mail to include a wide variety of goods, such as manufactured products, perishables, and specialized equipment.
- 32 General aviation, as defined by the International Civil Aviation Organization (ICAO), encompasses all civil aircraft operations that are not classified as commercial air transport or aerial work. This category includes a wide range of activities such as private and personal travel, air sports, tourism, and recreational flying. In essence, general aviation represents the private and leisure-oriented aspects of aviation. Notably, the majority of global air operations fall under the umbrella of general or private aviation. The classification of a flight as either commercial or non-commercial typically depends on its primary purpose, though this distinction can sometimes be challenging to determine. Private flights, for instance, can involve a variety of aircraft, from light and ultra-light planes to sport and homebuilt aircraft, gliders, and helicopters. Such flights may operate under both visual flight rules (VFR) and instrument flight rules (IFR).
- 33 Within general aviation, business or corporate aviation occupies a distinct and significant niche. This sector involves the use of aircraft by companies and organizations to facilitate the transportation of personnel or goods in support of business operations.

9. Current Challenges

These aircraft are often smaller models, including piston-powered, turboprop, or business jets. Unlike commercial aviation, business aviation is defined by its emphasis on personalized travel, offering flexibility and reduced time spent waiting at airports. From a legal perspective, business aviation is classified under general aviation, as differentiating between business-related and other types of flights on a case-by-case basis would be impractical. Furthermore, business aviation is often subject to specific regulations, which may include provisions related to fuel taxation, minimum runway requirements, and pilot qualifications.

Contemporary military aircraft exhibit exceptional adaptability to diverse operational requirements, spanning transport planes, surveillance platforms, fighter jets, and Unmanned Aerial Vehicles (UAVs). Cutting-edge initiatives, such as the Future Combat Air System (FCAS), jointly developed by Germany, France, and Spain, alongside other sixth-generation fighter programs, highlight the commitment to advancing air combat technologies. The strategic role of aerial warfare has been prominently reaffirmed in recent events, particularly during the Russian invasion of Ukraine, where the dynamics of air superiority and aerial denial played pivotal roles in the conflict.

Recent advancements in private Unmanned Aerial Vehicles (UAVs) have garnered significant attention, particularly due to the reduction in cost and marked enhancements in quality and user experience. This increased accessibility has resulted in a surge in drone use by individuals lacking formal training, prompting the establishment of numerous national and regional regulatory frameworks to address concerns regarding safety, security, and liability. A particularly prominent issue in this context is the inappropriate operation of drones near airports, which has disrupted airport activities and caused delays across broader aviation networks.

9. Current Challenges

Despite the numerous opportunities presented across various sectors of aviation – whether through technical innovation or economic advancements – the industry is confronted with significant challenges.

Arguably, climate change and its associated impacts represent the most pressing concern for the aviation sector today. As a global form of transportation powered predominantly by fossil fuels, with 38.9 million flights conducted in 2019 alone, aviation contributes notably to the exacerbation of climate change. Its environmental impact stems primarily from carbon dioxide emissions into the atmosphere, as well as non-carbon dioxide effects such as contrail formation, which collectively account for approximately 5% of anthropogenic climate change. Consequently, the industry faces growing pressure from regulators and stakeholders, including passengers and investors.

In response, public authorities worldwide have implemented legislation aimed at mitigating aviation's environmental footprint. Among the most prominent measures is the European Union Emissions Trading System (EU ETS), which introduces a carbon pricing mechanism through tradable emission certificates. These certificates allocate permissible emission quotas to entities such as airlines, requiring them to purchase additional certificates or face substantial penalties if their emissions exceed the allocated limits.

Beyond regulatory actions, climate change is also a matter of public perception. Aviation is often viewed as a major contributor to climate change and frequently features in related public discourse. While the industry has demonstrated sustained growth over recent years (excluding the disruptions caused by the COVID-19 pandemic), its negative

Chapter 1 Development of Air Traffic

reputation may influence investment patterns and consumer behavior, as individuals increasingly consider environmental factors in their travel decisions.

40 Moreover, the direct operational consequences of climate change pose challenges to commercial aviation. These include heightened weather variability, such as increased storms, temperature fluctuations, icing, and changes in wind patterns. Such factors must be integrated into the operational planning of airlines and airports, as well as into the design and development of next-generation aircraft.

41 Recognizing the gravity of climate change, the aviation industry has taken proactive measures to address this threat. At the international level, organizations such as the International Civil Aviation Organization (ICAO) and the International Air Transport Association (IATA) have committed to achieving net-zero carbon emissions by 2050, in alignment with the objectives of the Paris Agreement. In pursuit of this goal, ICAO introduced the Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA) in 2016, a market-based mechanism specifically tailored to the aviation sector.

42 Aircraft manufacturers and original equipment manufacturers have also invested extensively in research aimed at reducing aviation's climate impact. Although public discussions often focus on Sustainable Aviation Fuels (SAF), the range of solutions is far broader. Innovations such as advanced flight planning technologies, direct emissions capture systems on the ground, and emerging propulsion methods like hydrogen fuel have the potential to significantly transform the industry's environmental footprint.

43 While the increasing digitization of aviation presents numerous opportunities, it also introduces significant risks. As this digital transformation advances, the likelihood of hostile cyberattacks targeting the software systems of airlines and airports grows, potentially causing operational disruptions, flight cancellations, and serious threats to aviation security. The aviation industry is particularly susceptible to such attacks due to its wealth of passenger data and its stringent security and safety requirements. Although no cyberattacks on in-flight aircraft have been reported, critical infrastructure, including airports and airline bases, has already been subjected to such incidents.

44 In response to these threats, industry organizations have taken proactive measures to address cybersecurity risks. ICAO, which holds authority over aviation security, has issued Standards and Recommended Practices (SARPs) since the early 2000s. Similarly, the International Air Transport Association (IATA) advocates for global cooperation and provides guidance through specialized manuals and training programs. To effectively tackle the challenges posed by cyberattacks, sustained efforts from all industry stakeholders will be essential to minimize, and ideally prevent, future damage.

10. Trends and Developments

45 Aviation has long been recognized as a dynamic and rapidly evolving industry, marked by continual innovation and technological progress. As the sector advances, it faces both opportunities and challenges. Airlines are prioritizing investments in fuel-efficient aircraft, exploring the potential of alternative energy sources such as biofuels, and implementing environmentally friendly operational practices. Furthermore, the development of electric and hybrid-electric propulsion systems is laying the foundation for a more sustainable future in aviation.

46 Simultaneously, new transportation paradigms are emerging, notably the concept of Urban Air Mobility (UAM). This vision envisions the use of electric vertical take-off and landing (eVTOL) aircraft to enable efficient, congestion-free urban travel. Efforts

10. Trends and Developments

to develop eVTOL prototypes are well underway, with the aim of transforming urban transportation and alleviating traffic congestion.

Aviation, like many other industries, is undergoing a profound digital transformation. 47
Advanced technologies, including artificial intelligence (AI), machine learning, and big data analytics, are being employed to enhance operational efficiency, improve the passenger experience, and optimize maintenance processes. Innovations in in-flight connectivity are further refining the travel experience by providing passengers with high-speed internet access and real-time journey updates.

Additionally, the distinction between aviation and space exploration is becoming increasingly blurred with the advent of space tourism. Recent developments have allowed 48
companies to offer suborbital and orbital flights to private individuals. As technological advancements continue and associated costs decrease, space tourism could become accessible to a broader demographic.

Despite challenges, aviation remains central to global connectivity, with demand for 49
air travel anticipated to grow. From sustainability and digitalization to space exploration and evolving passenger preferences, the industry is undergoing transformative changes that are reshaping how we travel, connect, and explore the world. As technological progress accelerates and the sector adapts to new circumstances, the future of aviation holds promise for unparalleled innovation, enhanced connectivity, and boundless possibilities.

Index

Bold numbers refer to articles, normal ones to margin numbers.

- Accident Investigations **9** 1 ff.
- ACMI **1** 30
- Air Carrier **1** 13, 26, **2** 35
 - ACMI **1** 30
 - cargo **1** 23, 31
 - charter **1** 30
 - community air carrier **6** 17
 - low-cost **1** 29
 - regional **1** 28
 - scheduled **1** 27, 30
- Aircraft
 - airworthiness **11** 53 ff.
 - civil **5** 1
 - continuing airworthiness **11** 64
 - delivery **11** 46
 - initial Airworthiness **11** 62 f.
 - inspection **11** 45
 - leasing **11** 10 ff.
 - ownership **11** 4 ff.
 - registration **5** 29 f.
 - registry **11** 5
 - rights in **11** 3 ff.
 - rights in engines **11** 7 ff.
 - sale and purchase **11** 37 ff.
 - securities **11** 18 ff.
 - state **4** 45 ff.
 - type certification **11** 58 ff.
 - use of weapons **4** 56 ff.
- Aircraft accident and incident investigation **9** 22 ff.
- Aircraft commander **15** 61 ff.
- Aircraft in distress **9** 1 ff.
- Aircraft nationality **4** 10, **5** 26 ff.
- Air defense identification zones **17** 19
- Airline **1** 11, 18, **2** 35
 - ACMI **1** 30
 - cargo **1** 23, 31
 - charter **1** 30
 - low-cost **1** 29
 - regional **1** 28
 - scheduled **1** 27, 30
- Airline Deregulation Act **1** 18, **6** 39
 - EU-US open skies **6** 43
- Airport **12** 1 ff.
 - certification **12** 7
 - coordination **12** 36 ff.
 - design manuals **12** 8
 - ownership and operation **12** 14 ff.
 - planning manuals **12** 8
 - revenues **12** 30 ff.
 - safety regulation **12** 6 ff.
 - security **12** 9 ff.
 - services manuals **12** 8
 - slot Management **12** 36 ff.
- Air service **4** 51, **5** 2
 - agreements **6** 1
 - cabotage **5** 20 ff.
 - freedoms of the air **5** 39 ff., 51 ff., 56 ff.
 - international **5** 7 ff.
 - International Air Services Transit Agreement **5** 42 ff.
 - International Air Transport Agreement **5** 42, 50 ff.
 - non-scheduled **5** 3, 11 ff.
 - scheduled **5** 3 ff.
 - traffic rights **5** 40 ff.
- Air Services Agreement **6** 1 ff.
 - Bermuda I **6** 30 ff.
 - Bermuda II **6** 35 ff.
 - bilateral **4** 1, **6** 8, 26
 - capacity **6** 94 ff.
 - change of gauge **6** 58
 - Chicago template **6** 27 ff.
 - designation **6** 60 ff.
 - elements **6** 47 ff.
 - fair and equal opportunity **6** 11 ff.
 - frequencies **6** 94 ff.
 - legal status **6** 4
 - multilateral **4** 1
 - open skies **6** 39 ff.
 - ownership and control **6** 70 ff.
 - principles **6** 6 ff.
 - reciprocity **6** 9 f.
 - route schedules **6** 55 ff.
 - structure **6** 44 ff.
 - tariff setting **6** 103 ff.
 - traffic rights **6** 48 ff.
 - types **6** 25 ff.
- Air sovereignty **4** 34 ff., **5** 1
- Airspace **4** 4
 - closure **5** 34 ff.
- Air Traffic
 - history **1** 1 ff.
- Airworthiness **11** 53 ff.
- Alert Area **17** 17
- Antarctic Treaty **4** 39
- Archipelagic sea lane **17** 14
- Armed conflict **17** 25 ff.
- Artificial intelligence **14** 7
- Aviation
 - artificial intelligence **14** 7
 - business **1** 33
 - cargo **1** 23, **2** 42
 - civil **1** 13, **4** 16, 44, 49 ff.
 - commercial **1** 11, 26
 - corporate **1** 33
 - cyber attacks **1** 43 f.
 - deregulation **1** 17, 20; f
 - development **1** 1 ff.

Index

- digitalization 1 49
- digital transformation 1 43 f.
- eVTOL 1 46
- general 1 32 f.
- history 1 1 ff., 2 1
- infrastructure 1 43 f.
- international 4 1, 49
- law 2 2 ff.
- liberalization 1 17, 20; f
- military 1 34
- policy 2 15 ff.
- safety 7 1 ff.
- security 2 26
- UAM 1 46
- Aviation law 2 2 ff.
- international 2 8 ff., 12 ff., 3 1 f., 4 1
- national 2 8 ff.
- national law 3 31 ff.
- private 2 5 ff.
- private international law 3 21 f.
- public 2 5, 7 ff.
- public international 3 6 ff.
- regionalization 3 5
- safety 2 20 ff., 7 1 ff.
- security 2 26
- Aviation policy 2 15 ff., 31
- Aviation safety
- airworthiness of Aircraft 7 29 ff.
- EASA 7 43 ff.
- European Union 7 43 ff.
- IATA 7 42
- international cooperation 7 38 ff.
- operation of aircraft 7 21 ff.
- personnel licensing 7 11 ff.
- Regional Safety Oversight Organisations 7 38 ff.
- rules of the air 7 17 ff.
- safety management 7 36 ff.
- Universal Safety Oversight Audit Programme 7 38 ff.
- Aviation Security 8 1 ff., 15 1 ff.
- Airports 12 9
- Air Services Agreements 8 33 ff.
- Cyber 16 1 ff.
- Definition 8 16
- International 8 6 ff.
- Balloon 1 9, 2 22, 26, 4 5
- History 1 4 ff.
- Beijing Convention 15 41 ff., 16 17 ff.
- Jurisdiction 15 57 ff.
- Rules 15 53 ff.
- Scope 15 44 ff.
- Beijing Protocol 15 39 f.
- Bermuda I 6 30 ff.
- Bermuda II 6 35 ff.
- Blériot, Louis 1 8
- Brundtland Report 18 7
- Brussels Protocol (1938) 13 106
- Cabotage 5 20 ff.
- Cape Town Convention
- structure 11 26
- Cape Town Convention and Aircraft Equipment Protocol 11 25, 50
- aircraft object 11 31
- default remedies 11 34 ff.
- IDERA 11 36
- international interest 11 29 ff.
- international registry 11 32 f.
- Cargo 1 23, 31, 2 42
- Carrier liability 13 1 ff.
- Certificate of airworthiness 11 62
- Chicago Conference 4 2, 26 ff., 6 1
- United Kingdom 4 23 ff.
- United States 4 20 ff.
- Chicago Convention 2 25, 4 1, 15, 16 ff., 29 ff., 41 ff., 5 1 ff., 6 5
- Annex 17 16 11 ff.
- Annexes 4 77 ff.
- Article 3bis 4 56 ff.
- Article 8 10 7 ff.
- criticism 4 88 ff.
- Magna Charta 4 30
- safety 7 4, 8 ff.
- SARP 4 77
- Unmanned aircraft systems (UAS) 10 14 f.
- CINA 4 10
- CITEJA 3 3
- Civil Aviation 1 13, 4 44
- Climate change 1 37 ff., 2 46, 20 9 ff.
- aircraft technology 18 42 ff.
- aviation 18 33 ff.
- European law 18 66 ff.
- ICAO 18 33 ff.
- ICAO basket of measures 18 38 ff.
- offsetting 18 53 ff.
- operational improvements 18 45 ff.
- SAF 18 49 ff.
- treaties 18 6 ff.
- Climate litigation 18 86 ff.
- Commercial aviation 1 11, 26
- Commission Internationale de Navigation Aérienne 4 10
- Community air carriers 14 14 ff.
- Consumer protection
- Regulation (EC) 261/2004 2 11, 48
- Controlled firing area 17 17
- Corporate aviation 1 33
- CORSIA 1 41, 18 53 ff.
- compliance cycles 18 59 ff.
- implementation 18 59 ff.
- phases 18 57 ff.
- SAF 18 63
- scope 18 57 ff.
- COVID 19 1 21 ff., 39
- Criminal aviation law 15 1 ff.

Index

- Cybersecurity 1 43 f., 44, **16** 1 ff., **20** 16 ff.
 - EASA **16** 18 ff.
 - European Union **16** 18 ff.
 - FAA (United States) **16** 22 f.
 - framework **16** 8 ff.
 - ICAO **16** 9 ff.
 - ICAO Assembly Resolutions **16** 14 ff.
 - national frameworks **16** 18 ff.
 - risks **16** 2 ff.
- Data Protection **20** 16
- Denied boarding
 - European Union (historical) **14** 6 ff.
- Deregulation 1 17, 20; f
- Digitalization 1 49
- Diversions 17 8
- Drone **10** 1 ff.
- EASA 3 39
- Environment 2 46, **20** 9 ff.
 - space **19** 9
- EU Climate Law **18** 66 ff.
- EU ETS 1 37 ff., **18** 67 ff.
 - aviation **18** 73 ff.
 - cap and trade **18** 70 ff.
 - fit for 55 **18** 76 f.
 - scope **18** 73 ff.
- European Air Passenger Regulation **14** 10 ff.
- European Civil Aviation Conference (ECAC)
 - security **8** 37 ff.
- European Union Aviation Safety Agency 3 39
- European Union Emissions Trading System (EU ETS) 1 37 ff.
- eVTOL 1 46
- Farman brothers 1 11
- Fauchille, Paul 2 15 ff., 4 4
- Flight safety 2 20 ff.
- Framework Convention **18** 11 ff.
- Freedoms of the air 5 39 ff., 51 ff., 56 ff., **6** 48 ff.
- General Aviation 1 32 f.
- Geneva Convention (1948) **11** 6, 20 ff.
- Guadalajara Convention (1961) **13** 10
- Guatemala City Protocol (1971) **13** 12, 59
- Hague Convention (1970) 2 13
- Hague Hijacking Convention (1970) **15** 29 ff.
 - rules **15** 36 ff.
 - scope **15** 30 ff.
- Hague Protocol (1955) **13** 8 f.
- High Seas 17 11
- Hijacking **15** 26 f., 29 ff.
- IATA 1 11, 13, **3** 44, 7 42
- IATA Intercarrier Agreement (1995) **13** 14
- Ibero-American Air Transport Convention (1926) 4 12 f.
- ICAO 1 13, 2 24, 52, **3** 9, 36 ff., 4 28, 60 ff., 5 7
 - Air Navigation Committee 4 75 f.
 - assembly 4 64 ff.
 - Committee on Aviation Environmental Protection **18** 34
 - CORSIA **18** 53 ff.
 - council 4 70 ff.
 - criticism 4 88 ff.
 - PANS-Aerodromes **12** 8
 - secretariat 4 73 ff., **18** 34
 - Secretary General 4 73
 - unmanned aircraft systems (UAS) **10** 6 ff.
- Infrastructure 2 39 ff.
- Inspections 17 8
- Interceptions 17 8 f.
- International Air Services Transit Agreement 5 42 ff.
- International airspace 17 11 f.
- International Air Transport Agreement 5 50 ff., 6 1
- International Air Transport Association 1 13, 3 44
- International Civil Aviation Organization 1 13, 2 24, 52, 3 36 ff., 4 28, 60 ff.
 - Air Navigation Committee 4 75 f.
 - assembly 4 64 ff.
 - council 4 70 ff., 5 7
 - criticism 4 88 ff.
 - secretariat 4 73 ff.
 - Secretary General 4 73
- International Civil Aviation Organization 3 9
- Kyoto Protocol **18** 21 ff.
 - aviation **18** 26
 - emission targets **18** 23 ff.
 - market-based mechanism **18** 25
- Leasing **11** 10 ff.
 - ACMI **11** 15
 - damp **11** 16
 - dry **11** 13 ff.
 - finance leasing **11** 48 ff.
 - wet **11** 15
- Liability **13** 1 ff.
- Liability Convention (space) **19** 8, 11
- Liberalization 1 17, 20; f
- Lighter-than-air
 - history 1 4 ff.
- Low cost carrier 1 18, 29
- Madrid Convention (1926) 4 12 f.
- Magna Charta 4 30
- Military aviation 1 34, **17** 1 ff., 20 ff.
 - Aerial Blockade 17 37
 - Airspace **17** 10 ff., 32 ff.
 - Due Regard 17 5
 - Exclusion Zones **17** 36
 - No Fly Zones **17** 34 f.
 - Peacetime **17** 2 ff.

Index

- Warning Zones 17 33
- Military Exercise and Training Area 17 17
- Montgolfier brothers 1 4 ff., 2 22
- Montreal Additional Protocols No. 1-4 (1975) 13 13
- Montreal Convention (1971) 15 41 ff.
 - Jurisdiction 15 57 ff.
 - Rules 15 53 ff.
 - Scope 15 44 ff.
- Montreal Convention (1999) 2 13, 13 15 ff.
 - accident 13 33 ff.
 - actual carrier and contractual carrier 13 91 f.
 - agents and Servants 13 93
 - aircraft (scope) 13 24
 - Article 22 13 57 ff.
 - baggage 13 39 ff.
 - basis of claim 13 26 ff.
 - cargo 13 43 ff.
 - carriage 14 17
 - claimant (cargo) 13 45
 - contract rules 13 85
 - contractuality 13 23
 - contributory fault 13 62
 - damage (cargo) 13 44
 - delay 13 49 ff.
 - exclusivity 13 86 ff.
 - exoneration (cargo) 13 47
 - fifth forum 13 80 ff.
 - fora 13 64 ff.
 - gratuitous carriage 13 25
 - internationality 13 21 f.
 - jurisdiction 13 64 ff.
 - liability period (cargo) 13 46
 - liability period (passengers) 13 35 ff.
 - limits (baggage) 13 57 ff.
 - limits (cargo) 13 57 ff.
 - limits (passengers) 13 52 ff.
 - multiple carriers 13 91 f.
 - other defendants 13 90 ff.
 - passenger injury or death 13 27 ff.
 - presumed-fault liability 13 55 f.
 - recoverable damages 13 63
 - relation to the Warsaw System 13 15 ff.
 - revision of limits 13 61
 - scope 13 20 ff.
 - special declaration 13 58
 - special drawing rights 13 60
 - strict liability 13 53 ff.
 - third-parties 13 94
 - time limitation 13 84
 - two-tier liability 13 52 ff.
 - wilful misconduct 13 59
- Montreal Intercarrier Agreement (1966) 13 11
- Montreal Protocol (1988) 15 41 ff.
 - jurisdiction 15 57 ff.
 - rules 15 53 ff.
 - scope 15 44 ff.
- Montreal Protocol (2014) 15 8 ff.
 - aircraft commander 15 63 ff.
 - jurisdiction 15 24 f.
 - repressive 15 61 ff.
 - rules 15 22 ff.
 - scope 15 9 ff.
 - unlawful seizure 15 26 f.
- Moon Agreement 19 13 f.
- Multilateral agreements 2 12
- National airspace 17 13 f.
- National aviation law 2 8 ff.
- Nationality 4 10
 - aircraft 5 26 ff.
- Non-scheduled air service 5 3, 11 ff.
- Non-scheduled carrier 1 30
- NOTAM 17 16
- Offsetting 18 54 ff.
 - cap and trade 18 70 ff.
- Open Skies Agreements 6 19 ff., 22 ff., 39 ff.
 - EU-US 6 43
 - First generation 6 40
 - Second generation 6 41 ff.
- Outer Space
 - astronaut 19 10
 - delimitation 19 16 ff.
 - functionalist approach 19 18 f.
 - high altitude pseudo satalites 19 17
 - low earth orbit 19 24
 - mesospace 19 17
 - military use 19 7
 - moon 19 13 f.
 - New Space 19 20 ff.
 - registration 19 12
 - rescue 19 10
 - resolutions 19 15
 - spacecraft 19 10
 - spatialist approach 19 17, 19
 - van Kármán line 19 17
- Outer Space Treaty 19 4 ff.
 - military use 19 7
- Ownership and control 6 70 ff.
 - effective control 6 81 ff.
 - European Union 6 87 ff.
 - external element 6 76 ff.
 - internal element 6 86 ff.
 - state practice 6 93 f.
 - substantial ownership 6 78 ff.
 - United States 6 91 ff.
- Pan-American Agreement (1928) 4 14, 29
- Paris Agreement (1919) 4 8 ff., 29, 18 28 ff.
 - aviation 18 31
 - nationally determined contributions 18 29
- Paris conference 4 5 ff.
- Paris Convention (1999) 5 1
- Passenger rights 14 1 ff.
 - international 14 68 ff.
- Pilotless aircraft 10 1 ff.
- Private aviation law 2 5 ff.

Index

- Product liability 13 116 ff.
- Prohibited airspace 17 18
- Prohibited areas 5 34 ff.
- Public aviation law 2 5, 7 ff.
- Public international law 3 10 ff.
 - customary international law 3 15
 - judicial decisions 3 16
 - treaties 3 13 f.
 - Vienna Convention on the Law of Treaties 3 17
- ReFuelEU Aviation 18 80 ff.
- Regional carrier 1 28
- Registration 5 29 f.
- Registration Convention (space) 19 12
- Regulation (EC) 1008/2008 14 14
- Regulation (EC) 1107/2006 14 57
- Regulation (EC) 261/2004 2 11, 48, 14 10 ff.
 - cancellation 14 36 ff.
 - compensation 14 30 ff.
 - contractual air carrier 14 20 ff.
 - delay 14 46 ff.
 - denied boarding 14 24 ff.
 - European Economic Area (EEA) 14 16
 - European Free Trade Association (EFTA) 14 16
 - exclusivity of the Montreal Convention 1999 14 61 ff.
 - extraordinary circumstances 14 42 ff.
 - flight 14 17 f.
 - flight cancellations 14 23 ff.
 - long delays 14 23 ff.
 - notice 14 59
 - operating air carrier 14 20 ff.
 - personal scope 14 19 ff.
 - reimbursement and re-routing 14 33 f.
 - right to care 14 35
 - scope 14 13 ff.
 - special provisions 14 57 ff.
 - territorial scope 14 14 ff.
 - up- and downgrading 14 54 ff.
 - volunteers 14 27 f.
- Res communis 19 6
- Rescue Agreement 19 10
- Restricted Airspace 17 18
- Rights in Aircraft 11 3 ff.
- Rome Convention (1933) 13 99 ff.
- Rome Convention (1952) 13 107 ff.
- SAF 1 42
- Safety 2 20 ff., 7 1 ff.
 - airworthiness of Aircraft 7 29 ff.
 - IATA 7 42
 - international cooperation 7 38 ff.
 - operation of aircraft 7 21 ff.
 - personnel licensing 7 11 ff.
 - Regional Safety Oversight Organisations 7 38 ff.
 - rules of the air 7 17 ff.
 - safety management 7 36 ff.
 - standards and recommended practices 7 8 ff.
 - Universal Safety Oversight Audit Programme 7 38 ff.
- Safety Management Systems 7 36 ff.
- Sale and lease back 11 52
- SARP 4 77 ff.
 - legal status 4 84 ff.
 - recommended practices 4 82 f.
 - standards 4 79 ff.
- Scheduled air carrier 1 27
- Scheduled air service 5 3 ff.
- Search and rescue services 9 14 ff.
- Search and rescue signals 9 19
- Security 2 26
- Security interests in aircraft 11 18 ff.
- Single European Sky 18 83
- Sovereignty 17 2 ff.
- Space 1 16
 - debris 19 24 ff.
 - mining 19 21 ff.
 - tourism 19 27
 - traffic management 19 25 f.
- Special Air Zone 17 15 ff.
- Special use airspace 17 15 ff.
- Standards and Recommended Practices 4 77 ff.
 - legal status 4 84 ff.
 - recommended practices 4 82 f.
 - safety 7 8 ff.
 - standards 4 79 ff.
- State aircraft 4 45 ff., 17 3
- Surface damage liability 13 95 ff.
- Sustainable aviation fuel 1 42, 18 49 ff.
- Tokyo Convention (1963) 15 8 ff.
 - aircraft commander 15 63 ff.
 - jurisdiction 15 24 f.
 - repressive 15 61 ff.
 - rules 15 22 ff.
 - scope 15 9 ff.
 - unlawful seizure 15 26 f.
- Traffic rights 5 40 ff., 6 12, 48 ff.
- Transit passage 17 14
- Transportation 2 39 ff.
- UNFCCC 18 8 ff.
 - aviation 18 19 ff.
 - bodies 18 12 ff.
 - conference of the parties 18 13
 - COP21 18 28
 - COP3 18 21
 - framework 18 11 ff.
 - obligations 18 15 ff.
 - secretariat 18 14
- United Nations Convention on Contracts for the International Sale of Goods (CISG) 11 40

Index

- United Nations Convention on the Law of the Sea (UNCLOS) 4 38, 17 11
- Unlawful seizure 15 26 f., 29 ff.
- Unmanned aerial vehicles 1 34 f.
- Unmanned aircraft systems (UAS) 10 1 ff.
- Annexes to the Chicago Convention (1944) 10 14 f.
 - Basic Regulation (EU) 2018/1139 10 17 ff.
 - certified category 10 24 f.
 - definition 10 2 f.
 - Delegated Regulation (EU) 2019/945 10 26 ff.
 - European Union 10 16 ff.
 - international 10 6 ff.
 - open category 10 21
 - regional 10 16 ff.
 - specific category 10 22 f.
- Unruly passengers 15 74 ff.
- Urban air mobility 1 46
- Use of weapons 4 56 ff.
- Vienna Convention on the Law of Treaties 6 4
- War
- Cold War 1 16
 - World War I 1 10, 2 30, 4 6, 8, 35
 - World War II 1 12, 2 33, 40, 4 15
- Warsaw Convention (1929) 13 5 ff.
- Guadalajara Convention (1961) 13 10
 - Hague Protocol (1955) 13 8
 - IATA Intercarrier Agreement (1995) 13 14
 - Montreal Additional Protocols No. 1-4 (1975) 13 13
 - Montreal Intercarrier Agreement (1966) 13 11 f.
 - revisions 13 7 ff.
- Warsaw System 13 4 ff.
- World Climate Conference 18 7
- World War I 1 10, 2 30, 4 6, 8, 35
- World War II 1 12, 2 33, 40, 4 15
- Wright brothers 1 7, 9, 2 15