Project

The 50 Most Important Parameters of the 60 Most Used Passenger Aircraft

Author: Sebastian Hirsch

Supervisor: Prof. Dr.-Ing. Dieter Scholz, MSME
Submitted: 2022-10-01

Faculty of Engineering and Computer Science
Department of Automotive and Aeronautical Engineering

DOI:
https://doi.org/10.15488/xxxxx

URN:
https://nbn-resolving.org/urn:nbn:de:gbv:18302-aero2022-06-17.015
Associated URLs:
https://nbn-resolving.org/html/urn:nbn:de:gbv:18302-aero2022-06-17.015

Any further request may be directed to:
Prof. Dr.-Ing. Dieter Scholz, MSME
E-Mail see: http://www.ProfScholz.de

This work is part of:
Digital Library - Projects & Theses - Prof. Dr. Scholz
http://library.ProfScholz.de

Published by
Aircraft Design and Systems Group (AERO)
Department of Automotive and Aeronautical Engineering
Hamburg University of Applied Science

This report is deposited and archived:
- Deutsche Nationalbiliothek (https://www.dnb.de)
- Repository of Leibniz University Hannover (https://www.repo.uni-hannover.de)
- Internet Archive (https://archive.org)
  Item: https://archive.org/details/TextHirsch.pdf

This report has associated published data in Harvard Dataverse:
https://doi.org/10.7910/DVN/YAHODP

Abstract

Purpose – This project creates a database of more than 60 passenger aircraft types, which are most in use (based on in-service data from 2020). The aircraft are characterized by the most important 50 parameters.
Methodology – Almost all parameters were retrieved from manufacturer's documents for airport and maintenance planning as well as from EASA and FAA type certificate data sheets. Numbers were uniformly converted to SI units or aviation units (nautical mile, knot, flight level).
Findings – In 2020 many aircraft were in storage but got also considered here. The Boeing 737-800 and the A320ceo account already for a 30% share of the market. With 60 aircraft types more than 94,66% of existing passenger aircraft are covered. The database contains general parameters, overall dimensions, parameters from the engine, cabin, fuselage, landing gear, wing and tail. In addition, fuel tank volume, mass, range, and parameters from cruise flight are available.
Research Limitations – For aircraft still in development, certificate data sheets and manufacturer's data will be available only after certification.
Practical Implications – The database is convenient for general use. It is available in Excel and HTML. The Excel table can be used to calculate further values and to easily add parameters.
Originality – The well known database from Jenkinson et al. is from 2001. This new approach includes recent aircraft types and shows its data sources.

DEPARTMENT OF AUTOMOTIVE AND AERONAUTICAL ENGINEERING

The 50 Most Important Parameters of the 60 Most Used Passenger Aircraft

Task for a *Project*

Background

When dealing with passenger aircraft, it is convenient to have a database with parameters at hand. As such, we never lose control of reality. A database exists since 2001 from Jenkinson et al. It is a good example, but has not been maintained or extended for two decades. It is time to start from scratch. The new database should have a source for each parameter in the database and at best a comparison of sources for each number. It should be possible to easily calculate new parameters from known parameters. We can e.g. calculate aspect ratio from span and wing area with $A = b^2/S$ (to give just one simple example) for all 60 aircraft in the database. Much data has been collected for special investigations (see e.g. on http://library.PofScholz.de) and could be included in this general database. Such a database could grow over the years by continuously adding parameters and aircraft. This could be done by other students.

Task

Task of this project is to build a database with passenger aircraft data in Excel and HTML. The subtasks are:

- Review a source (https://www.flightglobal.com/download?ac=73559) with a statistic about almost all passenger aircraft types and their number in use globally. Determine the aircraft types for which initially data should be considered.
- Review sources from which the most reliable data of passenger aircraft can be retrieved.
- Define the most important parameters for the database.
- Collect and curate numbers for the required data and build the database.
- Write a report in which all steps and thoughts are explained.

The report has to be written in English based on German or international standards on report writing.

Content

List of Figures

List of Tables

List of Symbols

b_H	Horizontal Tailspan
b_W	Wingspan
b_V	Vertical Tail Height
c_r	Root Chord
c_t	Tip Chord
$d_{F,I}$	Cabin Width
h_{CABIN}	Cabin Height
$h_{A/C}$	Aircraft Height
h_F	Fuselage Height
h_{CR}	Cruise Altitude
h_{MCR}	Maximum Certified Flight Level
l_{CABIN}	Cabin Length
$l_{A/C}$	Aircraft Length
l_T	Track (distance between the centerline of the wheels)
l_{WB}	Wheelbase (horizontal distance between the centers of the front and rear wheels)
m_{ML}	Maximum Landing Mass
$m_{M,pax}$	Maximum Passenger Mass (including baggage)
m_{MPL}	Maximum Payload
m_{MR}	Maximum Ramp Mass
m_{MTO}	Maximum Take-Off Mass
m_{MZF}	Maximum Zero Fuel Mass
m_{OE}	Operating Empty Mass
m_{PLMR}	Payload at Maximum Range
M_{CR}	Cruise Speed
M_{MO}	Maximum Cruise Mach
$n_{M,SEAT}$	Maximum Certified Seats
n_{SEAT}	Number of Seats in Standard Configuration
P	Equivalent Power (of a turboprop engine)
R_{MPL}	Range Maximum Payload
$R_{M,pax}$	Range with Maximum Passengers
R_{PLMR}	Maximum Range
S_H	Horizontal Tail Reference Area
S_{ref}	Wing Reference Area
S_V	Vertical Tail Reference Area
S_W	Wing Area
T_{TO}	Max. Rated Takeoff Thrust
V_{CABIN}	Passenger Compartment Volume
V_{CARGO}	Cargo Compartment Volume

V_{MO}	Maximum Cruise Speed
w_F	Fuselage Width

List of Greek Symbols

$\varphi_{25,W}$	¼ Chord Sweep Wing
$\varphi_{25,H}$	¼ Chord Sweep Horizontal Tail
$\varphi_{25,V}$	¼ Chord Sweep Vertical Tail
λ_H	Horizontal Tail Taper Ratio
λ_V	Vertical Tail Taper Ratio
λ_W	Wing Taper Ratio

List of Abbreviations

A/C	Aircraft
ACT	Additional Center Tank
APU	Auxiliary Power Unit
ceo	Current Engine Option
CAS	Calibrated Airspeed
CFR	Code of Federal Regulations
EAS	Equivalent Airspeed
EASA	European Union Aviation Safety Agency
EU-OPS	Air Operations Regulations of the European Union
FAR	Federal Aviation Regulations
FL	Flight Level
ICAO	International Civil Aviation Organisation
IFR	Instrument Flight Rules
IMC	Instrument Meteorological Conditions
ISA	International Standard Atmosphere
kt	knots (NM/h)
LRC	Long Range Cruise
MDA	Minimum Descent Altitude
MEL	Minimum Equipment List
MLM	Maximum Landing Mass
MOD	Modification
MPL	Maximum Payload
MRM	Maximum Ramp Mass
MTOM	Maximum Take-off Mass
MZFM	Maximum Zero Fuel Mass
N/A	Not Applicable
neo	New Engine Option
nm	nautical mile
OEM	Operating Empty Mass
OEM	Original Equipment Manufacturer
PAX	Passenger
TAS	True Airspeed
ULD	Unit Load Device
VMC	Visual Meteorological Conditions
WB	Wide Body
XLR	Extra Long Range

1 Introduction

1.1 Motivation

The number of different passenger aircraft types is increasing every year. It is a continuously development. The most used passenger aircraft includes small turbo props aircraft to large aircraft such as the Airbus A380. Some of the operating aircraft are no longer built but are still in use in large numbers in some countries.

To be able to compare the different passenger aircraft, it is helpful to build a database with the most important parameters. The target is thus to create a database that can be expanded in an ongoing process to provide an overview of the important parameters such as geometries, weights, range and so on. This database represents the first recent overview since Jerkinson et. al. in 2001.

1.2 Title Terminology

Important Parameter
The important parameters have been defined and selected within the project. The number of parameters has been limited to 50 but can be extended at any time.

Most Used
The most used passenger aircraft were selected based on the "World Airliner Census 2020" by Flightgobal (2020). A total of 94,66% of the operating aircraft (63 different aircraft types) are considered (see Database with Parameters of Passenger Aircraft – Census). Due to Covid-19, many passenger aircraft were in storage, but are also included.

Passenger Aircraft
"Passenger aircraft means aircraft used for transporting persons, in addition to the pilot or crew, with or without their necessary personal belongings." Utah 2019

1.3 Objectives

The target, as mentioned above, is to create a new passenger aircraft database that can be used for further research and comparison. An ongoing extension is additionally possible. Different aircraft have a variety of parameters that are helpful and have not been perviosly considered. Also, an aircraft type can be specified with many different configuration and weight options.

1.4 Literature Review

The data is mostly collected from official databases on the web. Due to ongoing developments and processes, the classic literature, like books, is in most cases no longer suitable, while the World Wide Web is updated and the main source in this project. Especially the certification relevant data is taken from the type certificates of the aircraft from EASA or FAA, which also include the ongoing changes, same as designated Airport Planning Manuals or similar documents such as aircraft handbooks. Third-party sources are used for historic operating aircraft without type certificates in typical countries. Detailed comparison of the data with various third-party sources confirms the selected values and lists them in the database. All selected aircraft in the database and the collected data is indicated with the corresponding source. Some data of the aircraft, especially the inner dimensions and the detailed dimensions of the wings and tails, are not published.

The different weight options of the aircraft are not listed. The options with the highest Take-off Mass (MTOM) or additional long-range variants with slightly different characteristics are considered.

For example, for the Boeing 767 database, the Airport Characteristics according to Boeing 2022 were used for most parameters. Other relevant sources are the Type Certificates according to EASA 2021 and FAA 2007. These sources cover the most selected parameters.

1.5 Structure of the Work

The report covers the following chapters:

Chapter 2 describes the content details of the database.

Chapter 3 briefly describes the manufacturers considered and the aircraft listed in the database.

Chapter 4 describes all the parameters of the database and provides background information.

Chapter 5 describes the database.

Chapter 6 contains the summary and a brief outlook for the database is given.

2 Database Setup

2.1 Selection of Aircraft

The basis for the aircraft list is the "World Airliner Census 2020" (Flightgobal 2020). This census lists all aircraft in service, in storage and on order with the respective airline. The 63 selected aircraft contain more than 94,66 % (Database with Parameters of Passenger Aircraft – Census) of the aircraft in service, as well as some of the best-selling newly developed aircraft, such as the Airbus A220. Other new aircraft developments are not currently considered due tolack of data and type certificates. A total overview of the aircraft considered and their number in service in 2020 as well as the number of orders can be found in Table 2.1.

Table 2.1 World Airliner Census 2020 - selected aircraft

Manufacturer	Model	In Service	Storage	Total	Order	Percen-tage
Boeing	737-800	3960	828	4788	0	16,43%
Airbus	A320ceo	2952	1180	4132	19	14,18%
Airbus	A321-200	1232	359	1591	34	5,46%
Airbus	A319ceo	856	387	1243	2	4,26%
Airbus	A320neo	890	119	1009	1879	3,46%
Boeing	737-700	773	206	979	0	3,36%
Boeing	777-300ER	656	19	805	15	2,76%
ATR	ATR 72-200/-210/-500/-600	524	271	795	118	2,73%
Airbus	A330-300	453	254	707	9	2,43%
Embraer	175	566	58	624	159	2,14%
Bombardier	CRJ100/200	284	317	601	0	2,06%
Boeing	737-900	400	156	556	0	1,91%
Boeing	787-9	422	118	540	277	1,85%
Airbus	A330-200	224	278	502	8	1,72%
Embraer	190	265	236	501	2	1,72%
Embraer	ERJ-145	255	224	479	0	1,64%
Bombardier	CRJ900	355	116	471	12	1,62%
De Havilland	Dash 8 Q400	317	145	462	15	1,58%
Boeing	777-200/-200ER	158	233	391	0	1,34%
Boeing	767-300/-300ER	180	185	365	0	1,25%
Boeing	787-8	250	113	363	41	1,25%
Airbus	A321neo	302	53	355	2191	1,22%
Boeing	737 Max 8	0	347	347	1722	1,19%
Airbus	A350-900	225	66	321	419	1,10%
Viking Air	Twin Otter	220	95	315	8	1,08%
Boeing	757-200	123	179	302	0	1,04%
Bombardier	CRJ700	217	74	291	0	1,00%

Airbus	A380	18	219	237	9	0,81%
Boeing	MD-80	49	183	232	0	0,80%
Beech Aircraft	Beechcraft 1900D	162	58	220	0	0,75%
Fairchild	Metro/Merlin	185	35	220	0	0,75%
Boeing	737-300	94	120	214	0	0,73%
ATR	ATR 42-300/-320/-500/-600	124	84	208	20	0,71%
Saab	340	128	60	188	0	0,64%
Boeing	737-500	80	81	161	0	0,55%
Embraer	195	111	50	161	0	0,55%
De Havilland	Dash 8 Q300	119	38	157	0	0,54%
Embraer	170	98	59	157	0	0,54%
De Havilland	Dash 8 Q100	104	48	152	0	0,52%
Boeing	717-200	91	54	145	0	0,50%
Boeing	737-400	60	81	141	0	0,48%
Sukhoi	Superjet 100	101	30	131	45	0,45%
Embraer	EMB-120 Brasilia	92	35	127	0	0,44%
Boeing	747-400	17	106	123	0	0,42%
Beech Aircraft	Beechcraft 1900C	102	19	121	0	0,42%
Fokker	100	80	29	109	0	0,37%
Beech Aircraft	Beechcraft B99	106	1	107	0	0,37%
BAe	Jetstream 31	71	30	101	0	0,35%
Antonov	An-24	74	23	97	0	0,33%
Fokker	50	60	26	86	0	0,30%
Airbus	A220-300	65	7	72	332	0,25%
Airbus	A330-900	32	15	47	196	0,16%
Airbus	A350-1000	38	5	43	119	0,15%
Airbus	A319neo	0	0	0	49	0,00%

2.2 Selection of Parameters

The selected aircraft parameters are divided into different groups (A/C, Engine, Cabin, Fuselage, Total, Landing Gear, Wing, Vertical Tail, Horizontal Tail, Cruise, Fuel, Range, Mass, Cargo, Seats). The largest portion is made up of the dimensions of the outer aircraft structure and the cabin. Other important parameters are the mass and technical data of the aircraft.

Table **2.2** lists all categories and associated parameters used in the database.

Table 2.2 Selected Parameters

A/C	Manufacturer
	Aircraft type
	Total number of operating A/C
	Option/Variant
Engine	No. of Engines
	Model
	Max. Rated Takeoff Thrust, T_{TO} [kN]
	Equivalent Power, P [kW]
	Propeller
Cabin	Length, l_{CABIN} [m]
	Max. Height, h_{CABIN} [m]
	Max. Width, $d_{F,I}$ [m]
	Passenger Compartment Volume, V_{CABIN} [m³]
Fuselage	Height, h_F [m]
	Width, w_F [m]
Total	Length, $l_{A/C}$ [m]
	Span, b_W [m]
	Height, $h_{A/C}$ [m]
Landing Gear	Track, l_T [m]
	Wheelbase, l_{WB} [m]
Wing	Area, S_W [m²]
	Taper ratio, λ_W
	1/4 Chord Sweep, $\varphi_{25,W}$ [°]
Vertical Tail	Area, S_V [m²]
	Height, b_V [m]
	Taper ratio, λ_V
	1/4 Chord Sweep, $\varphi_{25,V}$ [°]
Horizontal Tail	Area, S_H [m²]
	Span, b_H [m]
	Taper Ratio, λ_H
	1/4 Chord Sweep, $\varphi_{25,H}$ [°]
Cruise	V_{MO} [kt]
	M_{MO} [Mach]
	Cruise Speed, M_{CR} [Mach]
	Max. Certified Flight Level, h_{MCR} [FL]
	Cruise Altitude, h_{CR} [FL]
Fuel	Unusable Fuel [l]
	Optional Fuel [l]
	Max usable fuel [l]
Range	Max. Payload, R_{MPL} [nm]

	Max. Pax, $R\_{M.pax}$ [nm]
	Max. Range, R_{PLMR} [nm]
Mass	Max. Ramp, m_{MR} (MRM) [kg]
	Max. Take-Off, m_{MTO} (MTOM) [kg]
	Max. Landing, m_{ML} (MLM) [kg]
	Max. Zero Fuel, m_{MZF} (MZFM) [kg]
	Operating Empty, m_{OE} (OEM) (MZFM-MPL) [kg]
	Max. Payload, m_{MPL} (MPL) [kg]
	Payload at Max. Range, m_{PLMR} [kg]
Cargo	Volume, V_{CARGO} [m³]
	Cargo Capacity
	Max. Pallet Underfloor
Seats	Max. Seats, n_{Mseat}
	Std. Layout, $n\_{M,seat}$

2.3 Selection of Units

The metric system is mostly used for the database. Typical values for aviation are specified in a common aeronautical unit. Typical aeronautical units are:

- Speed [kt] / [Mach]
- Range [nm]
- Altitude [FL] (Flight level in hundred of feet)

The units for the values are given in Chapter 4 Parameter.

Conversion Factors

For some data, the values were given in imperial units only. In this case, the conversion factors used by Boeing for conversion were used (Boeing 2022a):

- 1 Pound [lb] = 0.45359237 Kilograms [kg]
- 1 U.S. Gallons [gal]= 3.78541180 Liters [l]
- 1 Inch [in] = 2.54000000 Centimeters [cm] = 0.0254 Meters [m]
- 1 Feet [ft] = 0.30480000 Meters [m]

Especially for the range kilometers are often used. Therefore, the conversion to nautical miles is necessary:

- 1 Kilometer [km] = 0.53996 Nautical Miles [nm]

3 Manufacturers and Aircraft

The manufacturers considered by the aircraft listed in the database are briefly described in the following section. In addition, the aircraft considered are listed.

3.1 Airbus

Airbus is the largest aircraft manufacturer in the world with over 125000 employees. The company is a designer, manufacturer and deliverer of aircraft and aircraft products. In addition to passenger aircraft, the portfolio also includes helicopters and products for defense and aerospace (Airbus 2022).

The Airbus aircraft are grouped into two categories. The first is the single aisle (SA) aircraft, which are normally used for short- and medium haul flights. The A220, originally developed by Bombardier as the CS100, is the newest Airbus aircraft du to the partnership between Airbus and Bombardier.

The SA aircraft, that are being considered are:

- A220-300
- A319ceo
- A319neo
- A320ceo
- A320neo
- A321ceo
- A321neo

The second groud ais the wide body (WB) or long range aircraft. The WB aircraft, that are being considered are:

- A330-200 (A330-203)
- A330-300 (A330-303)
- A330-900 (A330-941)
- A350-900 (A350-941)
- A350-1000 (A350-1041)
- A380 (A380-800)

3.2 Antonov

Antonov was founded in 1946 and since then the company has designed and manufactured more than 22000 aircraft. Today, many aircraft are still in operation in countries of the former Soviet Union (Antonov 2022).

The only Antonov aircraft considered and operated in Eastern European and Asian countries is:

- AN-24RV

3.3 ATR

ATR is a joint venture between Airbus and Leonardo. Since 1981, more than 1600 aircraft have been manufactured and delivered to over 200 airlines. The most important aircraft types are the ATR 42 and ATR 72, of which many variations have been developed (ATR 2022).

The ATR aircraft considered are:

- ATR 42 (42-500/-600)
- ATR 72 (72-212A/-600)

3.4 BAe

BAe (British Aerospace) was one of the leaders in aerospace and defense with over 42000 employees (BAE 1998). From the company emerged the present company BAE Systems.

BAe produced many different aircraft, especially for military purposes. The civil aircraft that is considered is:

- Jetstream 31/32

3.5 Beechcraft

Beechcraft has been active in aviation for over 50 years, specializing in turboprops and now part of Textron Aviation. Also associated to the company are Cessna and Hawker. (Textron 2022).

The most used and considered Beechcraft aircraft are:

- Beechcraft C99
- Beechcraft 1900C
- Beechcraft 1900D

3.6 Boeing

Boeing is the second largest designer, manufacturer and maintainer of passenger and freighter aircraft, as well as defense and space products. The company employs more than 140,000 people and has delivered over 10,000 commercial aircraft (Boeing 2022).

Like the Airbus aircraft, the Boeing aircraft are grouped into two categories, single aisle (SA) and wide body (WB). The new Boeing aircraft (777-9 and 737 MAX 10), which are not yet certified but for which a large number of orders have been received, are not included due to lack of data.

The Boeing SA aircraft considered are:

- MD-82/-88
- MD-87
- 717-200 HGW
- 737-300
- 737-400
- 737-500
- 737-700
- 737-800
- 737-900
- 737-900ER
- 737-8
- 757-200

The Boeing WB aircraft considered are:

- 747-400
- 747-400ER
- 767-300
- 767-300ER
- 777-200 Basic
- 777-200ER IGW
- 777-300ER
- 787-8
- 787-9
- 787-10

3.7 Bombardier

Bombardier is a leading manufacturer of business and regional jets and is headquartered in Quebec, Canada. For over 30 years, Bombardier has designed and manufactured over 5000 aircraft (Bombardier 2022).

The Bombardier aircraft considered are:

- CRJ200LR
- CRJ700ER
- CRJ900 (CL-6002D24)

3.8 De Havilland

De Havilland was founded as early as the late 1920s. The company specialized in the production of small turboprop aircraft and now owns the naming rights of the DHC-8 Dash 8, formerly built by Bombardier, under De Havilland Aircraft of Canada Limited (De Havilland 2022).

The De Havilland aircraft under consideration are the regional jets:

- Dash 8 Q100 (DHC-8-106)
- Dash 8 Q300 (DHC-8-301)
- Dash 8 Q400 (DHC-8-402)

3.9 Embraer

Embraer is the third largest manufacturer of commercial aircraft. Headquartered in São José dos Campos, Brazil, the company has over 18000 employees and has delivered more than 8000 aircraft and was founded in 1969 (Embraer 2022).

The Embraer aircraft considered are:

- EMB 120 ER
- EMB 145 ER/LR/XR
- Embraer 170
- Embraer 175 LR
- Embraer 190
- Embraer 195 AR

3.10 Fairchild

“Fairchild was an American aircraft and aerospace manufacturing company based at various times in Farmingdale, New York; Hagerstown, Maryland; and San Antonio, Texas. […] After the name change, the company purchased Swearingen and manufactured the Fairchild Swearingen Metroliner, a successful commuter aircraft that gained orders from the U.S. military as the C-26 Metroliner.” (Wikipedia 2022i)

The Fairchild aircraft considered are:

- Merlin (SA227-T)
- Metro (SA226-TC)

3.11 Fokker

Fokker was a Dutch aircraft manufacturer. Until its bankruptcy in 1996, the company produced over 1300 aircraft. The company became Fokker Aircraft Services B.V., which is the type certificate holder of Fokker F27, F28, 50, 60 ,70 and 100 aircraft types (Fokker 2022).

Fokker produced a large number of different aircraft. The aircraft models that are considered are:

- Fokker 50 (F27 Mark 050)
- Fokker 100 (F28 Mark 0100)

3.12 Saab

Saab was founded in Sweden in 1937 as a developer and manufacturer of aircraft. The focus was on military aircraft, but a total of over 1100 civil aircraft were also built (Saab 2022).

For Saab, only one aircraft type is considered:

- Saab 340B

3.13 Sukhoi

"The JSC Sukhoi Company […] was a major Soviet and is now a Russian aircraft manufacturer, headquartered in Begovoy District, Northern Administrative Okrug, Moscow, that designs both civilian and military aircraft. It was founded by Pavel Sukhoi in 1939 as the Sukhoi Design Bureau (OKB-51, design office prefix Su). During February 2006, the Russian government merged Sukhoi with Mikoyan, Ilyushin, Irkut, Tupolev, and Yakovlev as a new company named United Aircraft Corporation." (Wikipedia 2022m)

The Sukhoi aircraft considered are:

- Superjet 100 (SSJ100/95B)

3.14 Viking Air

Viking Air Ltd. is the Original Equipment Manufacturer (OEM) and Type Certificate holder of the discontinued De Havilland aircraft. The company remains a manufacturer of commercial aircraft and is headquartered in Sidney, Canada (Viking 2022).

Viking Air’s best-selling and designated aircraft is:

- Twin Otter (DHC-6 400)

Because of identical dimensions, the data of the 300s is additionally used.

4 Parameters

The parameters used for the database are described below. The single values are grouped into categories. For each parameter type, a brief description and definition is given, as well as the unit. From the originally required 20 parameters, the number has been extended to 49.

4.1 Aircraft

Manufacturer
The producer of the aircraft and owner of the type certificate.

Aircraft Type
The manufacturer and advertising designation of the aircraft. The official designation used in certification may differ, but is not memorable to most consumers.

Total number of operating aircraft
This data is from the aircraft census 2020 and is the basis of the aircraft considered in the database. Due to Covid-19, the number of aircraft in storage is greater than normal. Thus, the total number are the operating aircraft are In-Service, plus number of aircraft in storage. Due to the dynamic aircraft count, the number of ordered aircraft is also considered in the database.

Option/Variant
The aircraft type can have different variants with different specifications, but with the same type designation. The different weight variants are not taken into account. Differences can be, for example, a long-range variant with larger wings and additional fuel.

4.2 Engine

No. of Engines
The total number of engines used for normal flight. The auxiliary power unit (APU) is not considered.

Type
The typical type of the aircraft. This can be a jet engine that generated thrust or an engine for the propeller. Only one engine type is considered, which is mostly used by the customer or considered for the calculation of the range.

Take-off Thrust T_{TO} [kN]
The value of take off thrust is the maximum thrust used during the start of an aircraft and a value used for the power of an engine. Thrust is used only for jet engines.

Equivalent Power P [kW]
The equivalent power is used for the engine with the propeller. The unit is kilowatts, but the manufacturer also uses shaft horsepower, which is the power of the propeller measured at the shaft.

Propeller
The selected designation of the propeller. Only one typical type is considered.

4.3 Cabin

Cabin Length l_{CABIN} [m]
The length of the usable cabin of an aircraft. It is the length of cabin from the cockpit door on passenger cabin side to the end of the cabin at the bulkhead or, on small aircraft, the cargo compartment, as shown in Figure 4.1.

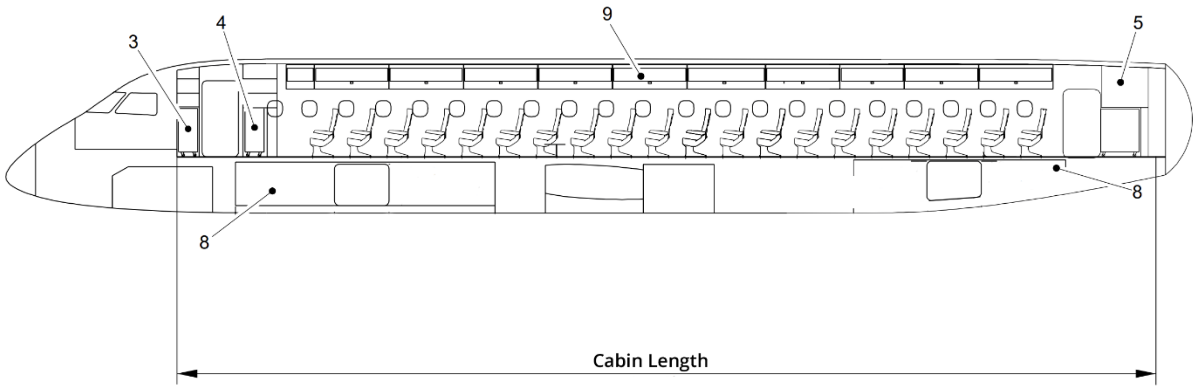

Figure 4.1 Cabin Side Section View (Embraer 2015)

Max. Height h_{CABIN} [m] / Max. Width $d_{F,I}$ [m]
The maximum usable height and width of the cabin, including the floor and lining, as shown in Figure 4.2.

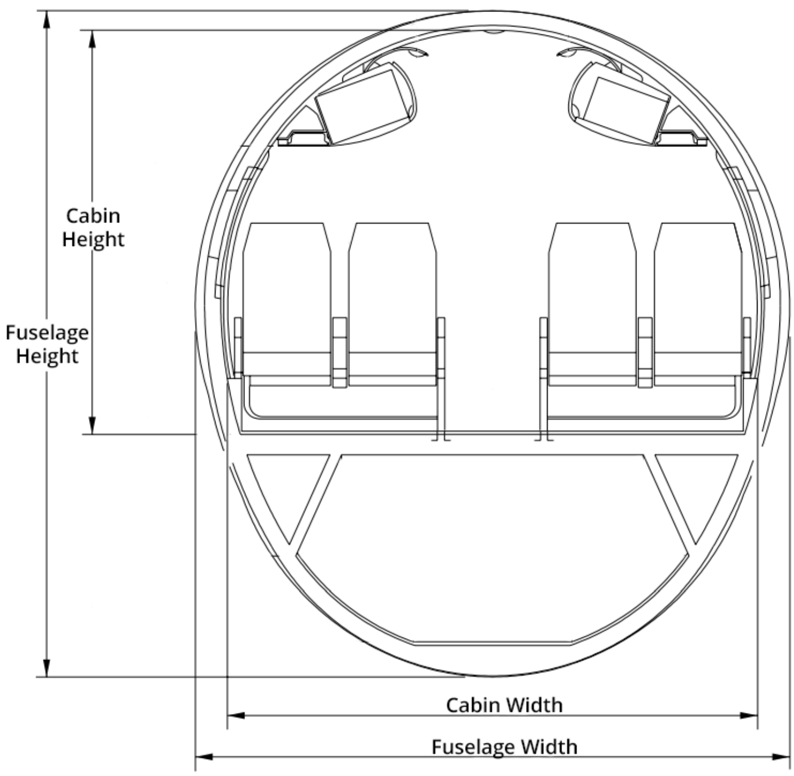

Figure 4.2 Section View of an Aircraft (Embraer 2015)

Cabin Volume V_{CABIN} [m³]
The total amount of usable volume within the empty aircraft cabin before configuration.

4.4 Fuselage

Height h_F [m] /Width w_F [m]
The maximum height and width of the fuselage, as shown in Figure 4.2.

4.5 Total

Length l_f [m]
Total length of the aircraft from the nose to the most aft point of the aircraft, as shown in Figure 4.3. This can be the upper part of the tail or the APU.

Span b_W [m]
The width of the aircraft at the wing, as shown in Figure 4.3.

Height h_f [m]
The total height of the aircraft at the vertical tail, as shown in Figure 4.3.

4.6 Landing Gear

The Landing gear information is an important element in airport planning. Especially for the airfield maneuvers.

Track l_T [m]
Distance of the wheels in Y-direction, as shown in Figure 4.3.

Wheelbase l_{WB} [m]
Distance between the front wheel and the aft wheels. The distance is measured from the centerline of the landing gear, as shown in Figure 4.3.

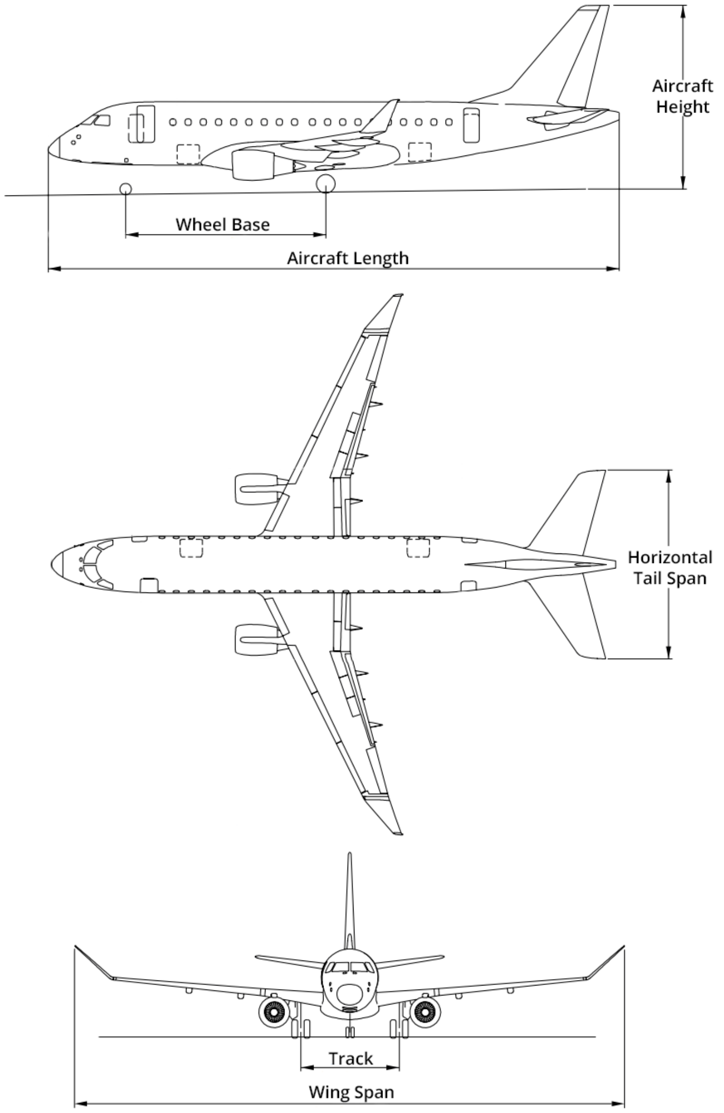

Figure 4.3 Aircraft Dimensions (Embraer 2015)

4.7 Wing / Vertical- / Horizontal Tail

Area S_W / S_V / S_H [m]

The area of a wing or tail is the projected area of the wing or tail and not the area of the surface. This includes the area of the wing or tail in the fuselage, as shown in Figure 4.4. This area is defined slightly differently depending on the manufacturer

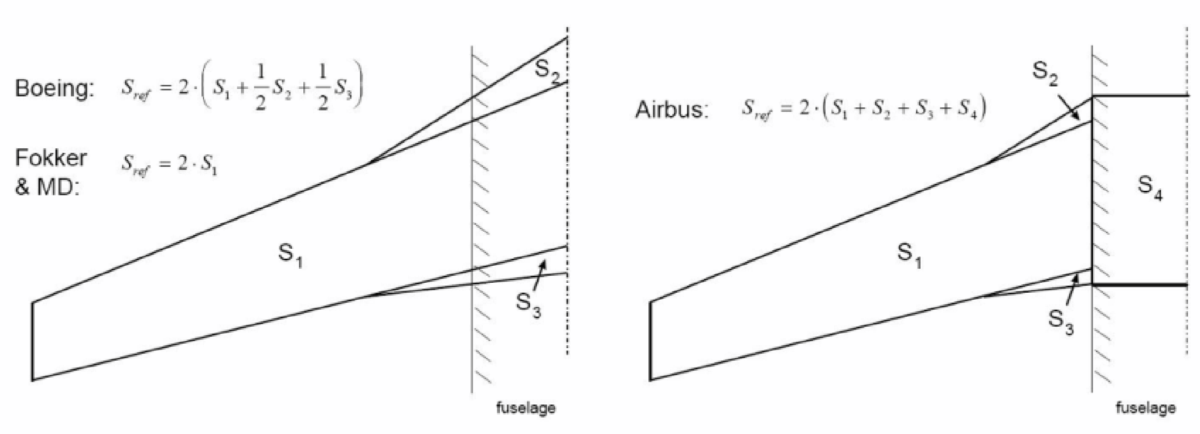

Figure 4.4 Reference area definitions of Boeing and Airbus (Scholz 1999)

¼ Chord Sweep φ_{25} [°]

The ¼ chord sweep angle is the angle of a wing at 25 % from the root chord c_r to 25 % of the tip chord c_t. The same calculation is used for the angle of the horizontal and vertical tail. Figure 4.5

Taper Ratio λ_W / λ_V / λ_H

The taper ratio is the ratio of tip chord c_t to root chord c_r and an important value for the lift distribution. The taper ratio is also an important value of the horizontal and vertical tail. For aircraft with optional winglets, the taper ratio is calculated without winglets.

$$\lambda = \frac{c_t}{c_r} \tag{1}$$

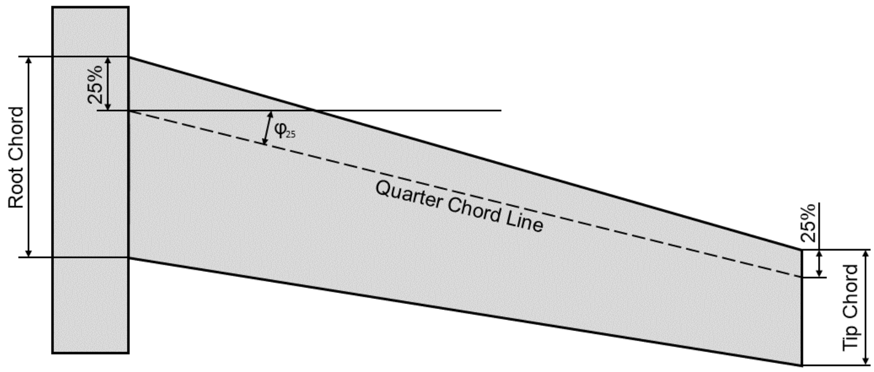

Figure 4.5 Aircraft Wing Geometry

Vertical Tail Height b_v [m]

The height of the vertical tail is measured from the lowest point of the tail to the highest point of the tail. Figure 4.6.

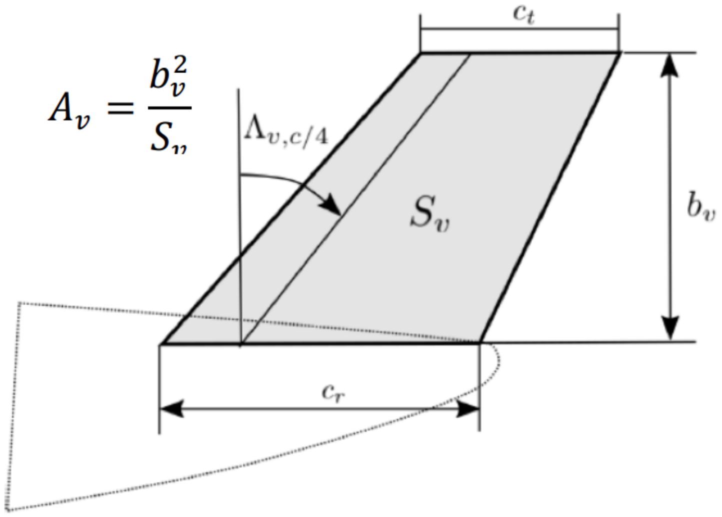

Figure 4.6 Geometry of a Vertical Tail (Nicolosi 2016)

Horizontal Tail Span b_T [m]
The maximum total width at the horizontal tail, as shown in Figure 4.3

4.8 Cruise

V_{MO} [kt] / M_{MO} [Mach]
The V_{MO} and M_{MO} are the maximum operating limit speed in knots and Mach (OFR 1962). The V_{MO} is given in TAS, which is the true airspeed and which is equal to the Mach speed M_{MO}. For some aircraft types, speed is given in calibrated airspeed (CAS), equivalent airspeed (EAS), or indicated airspeed (IAS). In these cases, the speed is converted to TAS. The Bislin 2019 calculator was used for the conversion.

True Airspeed (TAS)
"Calibrated Airspeed (CAS) corrected for altitude and non-standard temperature - the speed of the aircraft relative to the airmass in which it is flying." (Skybrary 2022c)

Calibrated Airpseed (CAS)
"Calibrated airspeed (CAS) is indicated airspeed corrected for instrument errors and position error (due to incorrect pressure at the static port caused by airflow disruption)." (Skybrary 2022d)

Equivalent Airspeed (EAS)
"Equivalent airspeed (EAS) is defined as the speed at sea level, under ISA conditions, that would produce the same incompressible dynamic pressure that is produced at the true airspeed and the altitude at which the vehicle is flying." (Skybrary 2022e)

Indicated Airspeed (IAS)
“The airspeed shown on the flight-deck instrument.” (Skybrary 2022f)

Mach Number
“The ratio between the the true air speed (TAS) and the local speed of sound (LSS). This ratio, which equals one when the TAS is equal to the LSS, is known as the Mach Number (M) and is very important in aircraft operating at high speed.” (Skybrary 2022g)

Cruise Speed M_{CR} [Mach]
The typical average speed of an aircraft, which is also used to calculate range. In some cases, the cruise speed is equal to the maximum operating speed.

Max. Certified Flight Level h_{MC} [FL]
The maximum certified altitude of an aircraft at standard air pressure, measured in hundreds of feet. (FAA 2018)

Cruise Altitude h_{CR} [FL]
The typical average flight level of an aircraft, which is also used to calculate range.

4.9 Fuel

For the quantity of the fuel, the fuel density used differs between the manufacturers and authorities. For the unknown conversion factors of the other manufacturers, the EASA factor is used.

- Boeing: 0,803 kg/l
- Boeing: 6,7 lb/gal
- Airbus: 0,785 kg/l
- EASA: 0,8 kg/l

Unusabe Fuel [l]
An aircraft fuel tank contains a quantity of unusable fuel that remains in the tanks.

Optional Fuel [l]
Some aircraft can be configured with additional fuel tanks. The optional tanks are not included in the maximum usable fuel quantity.

Max. Usable Fuel [l]
The maximum usable fuel of an aircraft during flight.

4.10 Range

The range of an aircraft depends on many different factors. The typical definition of range is given by the manufacturer. The conditions for the different ranges of an aircraft type are the same and given in the database as a note. The following is a brief explanation of the range parameter specifications.

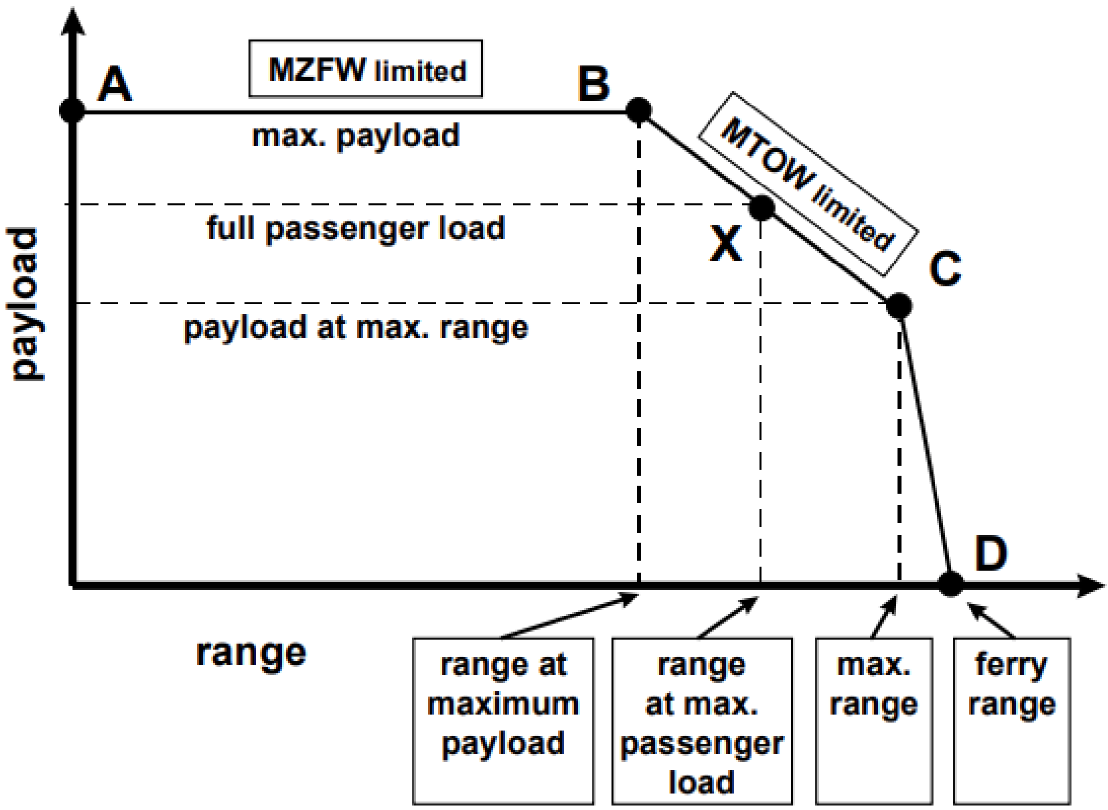

Figure 4.7 Payload-Range Diagram (Scholz 2015)

The range and mass are related to each other. According to Figure 4.7, the following parameters belong together:

Point B: m_{MPL} and R_{MPL}

Point X: $m_{M,pax}$ and $R_{M,pax}$

Point B: m_{PLMR} and R_{PLMR}

<u>ISA (International Standard Atmosphere)</u>

"The ISA is based the following values of pressure, density, and temperature at mean sea level each of which decreases with increase in height:

- Pressure of 1013.2 millibar - Pressure is taken to fall at about 1 millibar per 30 feet in the lower atmosphere (up to about 5,000 feet).

- Temperature of +15 °C - Temperature falls at a rate of 2 °C per 1,000 feet until the tropopause is reached at 36,000 feet above which the temperature is assumed to be constant at -57 °C. (The precise numbers are 1.98 °C, -56.5 °C and 36,090 feet)
- Density of 1,225 gm/m³.“ (Skybrary 2022)

For ISA+10 the temperature on sea level is 10°C higher.

IFR alternate
“Instrument Flight Rules (IFR) are rules which allow properly equipped aircraft to be flown under instrument meteorological conditions (IMC).” (Skybrary 2022a)

According to CFR § 135.223 IFR: Alternate airport requirements, an operation of an aircraft in IFR conditions is only allowed with enough fuel reserves:

“ (a) Except as provided in paragraph (b) of this section, no person may operate an aircraft in IFR conditions unless it carries enough fuel (considering weather reports or forecasts or any combination of them) to -

(1) Complete the flight to the first airport of intended landing;

(2) Fly from that airport to the alternate airport; and

(3) Fly after that for 45 minutes at normal cruising speed or, for helicopters, fly after that for 30 minutes at normal cruising speed.

(b) Paragraph (a)(2) of this section does not apply if part 97 of this chapter prescribes a standard instrument approach procedure for the first airport of intended landing and, for at least one hour before and after the estimated time of arrival, the appropriate weather reports or forecasts, or any combination of them, indicate that -

(1) The ceiling will be at least 1,500 feet above the lowest circling approach MDA; or

(2) If a circling instrument approach is not authorized for the airport, the ceiling will be at least 1,500 feet above the lowest published minimum or 2,000 feet above the airport elevation, whichever is higher; and

(3) Visibility for that airport is forecast to be at least three miles, or two miles more than the lowest applicable visibility minimums, whichever is the greater, for the instrument approach procedure to be used at the destination airport.” (CFR 1986)

IMC (Instrument meteorological conditions) (Skybrary 2022b)
"Instrument meteorological conditions (IMC) are meteorological conditions expressed in terms of visibility, distance from cloud, and ceiling, less than the minima specified for visual meteorological conditions (VMC). (ICAO Annex 2)

VMC are detailed in ICAO Annex 2: Rules of the Air, Chapter 4: Visual Flight Rules. Essentially, they are:

- When above 3,000ft or 1,000ft above terrain, whichever is higher:
  - 1500m horizontally and 1,000 ft vertically from cloud;
  - Flight visibility 5km below 10,000ft and 8km above 10,000ft.
- When below 3,000ft or 1,000ft above terrain, whichever is higher:
  - Clear of cloud and in sight of the surface;
  - Flight visibility 5km."

Domestic Reserves
"The "Domestic" reserve consists of a holding for 45 minutes at a speed of 220 knots (resulting in 306 km additional flight distance) and the distance to the alternate airport." (Burzlaff 2017)

Max. Payload R_{PL} [nm]
Point B at Figure 4.7 for the aircraft with maximum payload.

Max. PAX R_{MP} [nm]
The specific range is a theoretical value – Figure 4.7 point X. It is given for a standard layout with an average number of seats. For each passenger, a theoretical mass of 200 lb / 91 kg is normally used if no Max. PAX data has been specified. The number of passengers is indicated in the database under "Seats – Std. Layout". Some aircraft manufacturer uses passenger masses that are slight smaller or larger.

Max. Range R_{Max} [nm]
Figure 4.7 point C is the maximum range of the aircraft at practical payload and maximum fuel.

4.11 Mass

The EASA officially uses the term mass for the aircraft. A term also often used is weight, especially in manufacturers' manuals from the USA. The mass of an aircraft is composed of the empty weight, component that are necessary for the flight, such as cabin interior, equipment and the crew required fot the flight. Other components of mass include payload and fuel (Figure 4.8).

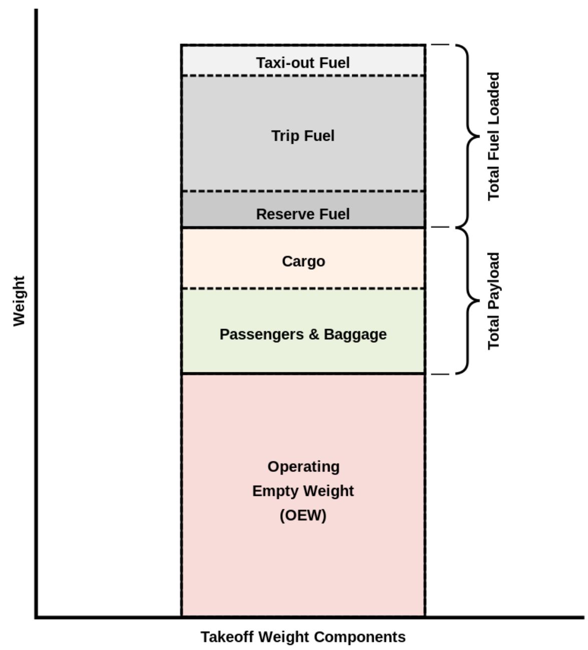

Figure 4.8 Takeoff Weight Components (Wikipedia 2022o)

Max. Ramp Mass (MRM) m_{MR} [kg]
"Maximum [mass] for ground maneuver as limited by aircraft strength and airworthiness requirements. (It includes [mass] of taxi and run-up fuel.)" (Boeing 2021, p.20)

Max. Take-Off Mass (MTOM) m_{MTO} [kg]
"Maximum [mass] for takeoff as limited by aircraft strength and airworthiness requirements. (This is the maximum [mass] at start of the takeoff run.)" (Boeing 2021, p.20)

Max. Landing Mass (MLM) m_{ML} [kg]
"Maximum [mass] for landing as limited by aircraft strength and airworthiness requirements." (Boeing 2021, p.20)

Max. Zero Fuel Mass (MZFM) m_{MZF} [kg]
"Maximum [mass] allowed before usable fuel and other specified usable agents must be loaded in defined sections of the aircraft as limited by strength and airworthiness requirements. The maximum permissible [mass] without fuel." (Boeing 2021, p.20)

Operational Empty Mass (OEM) m_{OE} [kg]
"[Mass] of structure, powerplant, furnishing systems, unusable fuel and other unusable propulsion agents, and other items of equipment that are considered an integral part of a particular airplane configuration. Also included are certain standard items, personnel, equipment, and supplies necessary for full operations, excluding usable fuel and payload." (Boeing 2021, p.20)
A calculation is possible with: MZFM-MPL. (Boeing 2021)

Max. Payload (MPL) m_{MPL} [kg]

"Maximum design zero fuel [mass] minus operational empty weight." (Boeing 2021, p.20)

Payload at Max. Range m_{PLMR} [kg]

The payload of an aircraft with maximum range and maximum fuel at point C in Figure 4.7.

4.12 Cargo

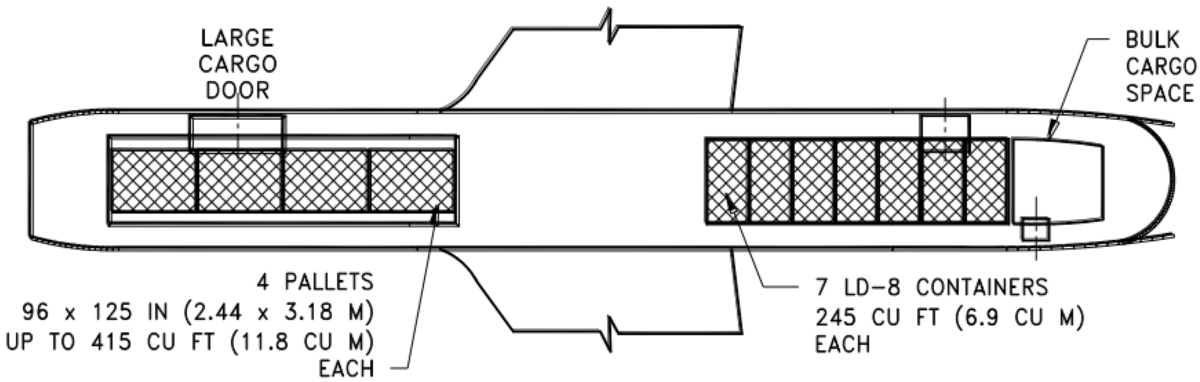

Figure 4.9 Cargo Area 767 (Boeing 2021)

Volume V_{CARGO} [m³]

Maximal usable volume of the cargo area, which includes the area for the baggage, the area for pallets or cargo container and bulk.

Cargo Capacity

The cargo containers are standardized in different sizes. Called until load device (ULD) the containers are used for luggage, freight, and mail. The sizes LD1, LD2 and LD3 are considered.

Max. Pallets Underfloor

For the transport of cargo, the maximum number of pallets is a very important value. Civil aircraft are often additionally used as cargo aircraft. Some passenger aircraft can be converted as cargo aircraft. The database shows the maximum possible number of pallets in the cargo area under the passenger cabin in the cargo area. Small aircraft usually do not offer the possibility of transporting pallets.

4.13 Seats

The number of seats incudes only the passenger seats. Seats for cabin attendants or pilot are not included in this value.

Max. Certified Seats n_{Mseat}

The maximum certified number of seats in this type of aircraft. The maximum number depends on the emergency exits and the number of passengers that can be evacuated in a time of 90 seconds. The maximum number of seats includes only one economy class.

Std. Layout n_{seat}

The typical number of passenger seats in the aircraft. This number is also used for the Max. PAX range of the aircraft. On small aircraft, the maximum certified number of seats is usually the typical number of seats. On larger aircraft, the typical number of seats can be much lower, as up to four different seating classes are used, for example, first class, business class, upper economy class and economy class.

5 Database Presentation

The database contains the World Airliner Census 2020, data categories, parameters, aircraft data, and associated sources.

- The data are divided into several tabs.
- The first tab includes all aircraft data.
- The second tab is the census data for passenger aircraft.
- Following each aircraft manufacturer, except Airbus and Boeing, with two tabs, because of the large number of aircraft types, has its own tab.
- The last tab contains the summary of sources.

The data in the manufacturers' tabs are listed with the corresponding sources, which can be found to the right of the data (Table 5.1). The information on the ranges is also included here.

N/A is indicated for the parameters for which no data is available. For parameters that are obsolete for the aircraft type, a dash is indicated.

Table 5.1 Example Database with Parameters of Passenger Aircraft

A/C	Manufacturer	Bombardier		Bombardier		Bombardier	
	Aircraft type	CRJ200		CRJ700		CRJ900	
	Total number of operating A/C	601	[1]	291	[1]	471	[1]
	Option/Variant	LR	[9]	ER	[6]	CL-6002D24	[3]
Engine	No. of Engines	2	[9]	2	[6]	2	[2]
	Model	CF34-3B1	[9]	CF34-8C1	[6]	CF34-8C5	[2]
	Max. Rated Takeoff Thrust, T_{TO} [kN]	41,01	[12]	61,34	[7]	64,54	[7]
	Equivalent Power, P [kW]	-		-		-	
	Propeller	-		-		-	
Cabin	Length, l_{CABIN} [m]	12,42	[11]	17,25	[8]	21,13	[5]
	Max. Height, h_{CABIN} [m]	1,84	[9]	1,89	[5]	1,89	[5]
	Max. Width, $d_{F,I}$ [m]	2,48	[9]	2,55	[5]	2,55	[5]
	Passenger Compartment Volume, V_{CABIN} [m³]	N/A		68,81	[8]	84,21	[5]
Fuselage	Height, h_F [m]	2,64	[11]	2,69	[6]	2,69	[2]
	Width, w_F [m]	2,69	[9]	2,69	[6]	2,69	[2]
Total	Length, $l_{A/C}$ [m]	26,77	[9]	32,3	[6]	36,24	[2]
	Span, b_W [m]	21,23	[9]	23,25	[6]	23,24	[2]
	Height, $h_{A/C}$ [m]	6,3	[9]	7,51	[6]	7,35	[2]
Landing Gear	Track, l_T [m]	3,14	[9]	4,12	[6]	4,07	[2]
	Wheelbase, l_{WB} [m]	11,4	[9]	15,01	[6]	17,3	[2]
Wing	Area, S_W [m²]	54,54	[11]	70,61	[6]	71,07	[2]
	Taper ratio, λ_W	0,32	[11]	0,26	[6]	0,25	[2]
	1/4 Chord Sweep, $\varphi_{25,W}$ [°]	24,5	[11]	26,5	[6]	26	[2]
Vertical Tail	Area, S_V [m²]	N/A		11,09	[6]	11,09	[2]
	Height, b_V [m]	3,46	[9]	3,61	[6]	3,28	[2]
	Taper ratio, λ_V	0,67	[11]	0,67	[6]	0,66	[2]
	1/4 Chord Sweep, $\varphi_{25,V}$ [°]	42	[11]	39	[6]	38,5	[2]
Horizontal Tail	Area, S_H [m²]	N/A		15,91	[6]	15,91	[2]
	Span, b_H [m]	6,2	[9]	8,54	[6]	8,54	[2]
	Taper Ratio, λ_H	0,46	[11]	0,42	[6]	0,47	[2]
	1/4 Chord Sweep, $\varphi_{25,H}$ [°]	31	[11]	29	[6]	28,5	[2]
Cruise	V_{MO} [kt]	507	[10]	507	[3]	507	[3]
	M_{MO} [Mach]	0,85	[10]	0,85	[3]	0,85	[3]
	Cruise Speed, M_{CR} [Mach]	0,8	[9]	0,7	[6]	0,7	[2]
	Max. Certified Flight Level, h_{MCR} [FL]	410	[10]	410	[3]	410	[3]
	Cruise Altitude, h_{CR} [FL]	370	[10]	N/A		N/A	
Fuel	Unusable Fuel [l]	54	[10]	87	[3]	128	[2]
	Optional Fuel [l]	-		-		-	
	Max usable fuel [l]	8082	[10]	10989	[3]	10861	[2]
Range	Max. Payload, R_{MPL} [nm]	1130	[1][9]	1230	[2][6]	1320	[3][2]
	Max. Pax, $R_{M,pax}$ [nm]	1830	[1][9]	1980	[2][6]	1986	[3][2]
	Max. Range, R_{PLMR} [nm]	2070	[1][9]	2280	[2][6]	1980	[3][2]
Mass	Max. Ramp, m_{MR} (MRM) [kg]	21319	[9]	34133	[6]	38555	[2]
	Max. Take-Off, m_{MTO} (MTOM) [kg]	24041	[9]	34019	[6]	38329	[2]
	Max. Landing, m_{ML} (MLM) [kg]	21319	[9]	30391	[6]	33340	[2]
	Max. Zero Fuel, m_{MZF} (MZFM) [kg]	19958	[9]	28260	[6]	32092	[2]
	Operating Empty, m_{OE} (OEM) (MZFM-MPL) [kg]	13835	[9]	20070	[6]	21845	[2]
	Max. Payload, m_{MPL} (MPL) [kg]	6124	[9]	8190	[5]	10247	[5]
	Payload at Max. Range, m_{PLMR} [kg]	4300	[9]	5580	[6]	7800	[2]
Cargo	Volume, V_{CARGO} [m³]	8,89	[9]	12,39	[6]	12,39	[2]
	Cargo Capacity	-		-		-	
	Max. Pallet Underfloor	-		-		-	
Seats	Max. Seats, $n_{M,SEAT}$	50	[9]	78	[3]	90	[2]
	Std. Layout, n_{SEAT}	50	[9]	70	[6]	86	[2]

Sources:
[1] https://www.flightglobal.co
[2] https://customer.aero.bom
[3] https://www.easa.europa.e
[4] http://mhirj-preview-files.s3
[5] https://web.archive.org/we
[6] https://customer.aero.bom
[7] https://www.easa.europa.e
[8] http://mhirj-preview-files.s3
[9] https://customer.aero.bom
[10] https://www.easa.europa.e
[11] https://www.fzt.haw-hamb
[12] https://www.easa.europa.e

Comments:
[1] Still Air, ISA conditions, z
[2] ISA, 138 lb taxi and APU
[3] ISA, 340 lb taxi and APU

6 Summary

In this project work, the most common aircraft in operation worldwide are presented side by side in a table with the most important parameters. In this context, the number of aircraft represents only a momentary overview. In detail, the data of the World Airliner Census 2020 is examined and 94.66% of the aircraft (63 different aircraft types) are selected. Further, the units and conversion factors used are highlighted, which are of particular importance due to the large number of resources used. The selected aircraft and manufacturers are briefly described and listed. In detail, the selected parameters and categories are described and the formula symbol and unit are given. Attention is paid to the definition in order to make the data comparable between the different aircraft types. Finally, the database and its structure are briefly explained.

7 Conclusion and Recommandations

The new database can be used and expanded for further research. For each value the source is given to trace the data and to give the possibility to add new parameters. The selected parameters cover only a small part of the data, which are useful for a representative scope. In particular, a large number of the data, which are of significant relevance for airport planning, are also recommended to be added. Furthermore, some aircraft types have many variants, especially in terms of mass, which can lead to many different results, especially in terms of range. Therefore, the effects and different data within an aircraft type can be supplemented for this purpose.

The data from Morichon 2006 can be used to expand the database, especially with aircraft types that are available in lower numbers, or are historical. Data on take-off and landing at the airport is also of significant benefit. The recommendation is to add parameters such as takeoff and landing distance as well as takeoff and landing speed to the database. Data is already available for some aircraft types in the project work of Müller 1999 and Niederkleine 1999. In addition, the Oswald's efficiency factor is of interest for aircraft design as already comprehensively determined in Niţă 2012.

List of References (Documentation)

AIRBUS, 2022. *Who we are*. Blacnac, France.
Available from: https://www.airbus.com/en/who-we-are
Archived at: https://perma.cc/Q2SF-BMAJ

ANTONOV, 2022. *Information About Company*. Kyiv, Ukraine.
Available from: https://antonov.com/en/activity
Archived at: https://perma.cc/5MFS-PYQ3

ATR, 2022. *Who we are*. Blacnac, France.
Available from: https://www.atr-aircraft.com/about/who-we-are/
Archived at: https://perma.cc/QE9X-3N82

BAE, 1998. *Introduction*. Farnborough, Hampshire, United Kingdom.
Archive at: https://bit.ly/3bKkKdw

BISLIN, Walter, 2019. *Rechner: Umrechnen von Fluggeschwindigkeiten*. Schweiz.
Available from: https://bit.ly/3NgYZ2q
Archived at: https://perma.cc/7P6E-EKBQ

BURZLAFF, 2017. *Aircraft Fuel Consumption – Estimation and Visualization.* Project. Hamburg, Germany: University of Applied Sciences (HAW Hamburg)
Available from: https://www.fzt.haw-hamburg.de/pers/Scholz/arbeiten/TextBurzlaff.pdf
Archived at: https://perma.cc/H9RP-ETPP

BOEING, 2021. 767 *Airplane Characteristics for Airport Planning*. Seal Beach, USA: Boeing Commercial Aircraft.
Available from: https://bit.ly/3szUWqp
Archived at: https://perma.cc/GP69-QH73

BOEING, 2021a. *787 Airplane Characteristics for Airport Planning*. Seal Beach, USA.
Available from: https://bit.ly/3PCRo08
Archived at: https://perma.cc/5UXS-VURU

BOEING, 2022. *Boeing in Brief*. Chicago, USA.
Available from: https://www.boeing.com/company/general-info/
Archieved at: https://perma.cc/NF9W-VFTP

BOMBARDIER, 2022. *Who we are*. Quebec, Canada.
Available from: https://bombardier.com/en/who-we-are
Archived at: https://perma.cc/4C5B-FRTB

CFR, 1986. *§ 135.223 IFR: Alternate airport requirements*. Washington DC, USA.
Available from: https://bit.ly/3PAQ8uE
Archived at: https://perma.cc/R85P-Q4WQ

COENE, Steven, 2008. *Conceptual Design of Wings and Tailplanes – Methods, Statistics, Tool Setup*. Master Thesis. Hamburg, Germany: University of Applied Sciences (HAW Hamburg)
Available from: https://www.fzt.haw-hamburg.de/pers/Scholz/arbeiten/TextCoene.pdf
Archived at: https://perma.cc/FZS6-67JS

DE HAVILLAND, 2022. *The De Havilland History*. Mississauga, Canada.
Available from: https://dehavilland.com/en/history
Archived at: https://perma.cc/35WQ-63FU

EASA, 2021. *Type-Certificate Data Sheet No. IM.A.035 for Boeing 767*. Cologne, Germany.
Available from: https://www.easa.europa.eu/downloads/8337/en
Archived at: https://perma.cc/9UYW-SB9Z

EMBRAER, 2015. *Embraer 175 Airport Planning Manual*. Sao Jose dos Campos, Brazil: Embraer S.A.
Available from: https://bit.ly/3sCfj69
Archived at: https://perma.cc/EDT7-FN69

EMBRAER, 2022. *About us*. Sao Jose dos Campos, Brazil: Embraer S.A.
Available from: https://embraer.com/global/en/about-us
Archived at: https://perma.cc/4DNG-FT6K

FAA, 2007. *Type Certificate Data Sheet No. A1NM*. Washington DC, USA.
Available from: https://bit.ly/39HUEan
Archived at: https://perma.cc/9KB2-NTKQ

FAA, 2018. *Pilot/Controller Glossary*. Washington DC, USA: Federal Aviation Administration.
Available from: https://bit.ly/3wkNGiU
Archived at: https://perma.cc/9YKL-B2QR

FLIGHTGLOBAL, 2020. *World Airliner Census 2020*. Sutton, United Kingdom.
Available from: https://www.flightglobal.com/download?ac=73559
Archived at: https://perma.cc/R3L2-3CJB

FOKKER, 2022. *History*. Hoofddorp, The Netherlands.
Available from: https://www.fokkerservices.com/about/history
Archieved at: https://perma.cc/LH5P-MZ8K

MORICHON, Lucie, 2006. *Selected Statistics in Aircraft Design*. Project. Hamburg, Germany: University of Applied Sciences (HAW Hamburg)
Available from: https://www.fzt.haw-hamburg.de/pers/Scholz/arbeiten/TextMorichon.pdf
Archived at: https://perma.cc/8WMX-78BN

MÜLLER, Paul, 1999. *Anpassung von Statistik-Gleichungen des Flugzeugentwurfs an neue Flugzeugtypen*. Diploma Thesis. Hamburg, Germany: University of Applied Sciences (HAW Hamburg)
Available from: https://www.fzt.haw-hamburg.de/pers/Scholz/arbeiten/TextMueller.pdf

NICOLOSI, Fabrizio, CILIBERTI, Danilo, DELLA VECCHIA, Pierluigi, CORCIONE, Salvatore, CUSATI, Vincenzo. 2016. A Comprehensive Review of Vertical Tail Design. In: *Aircraft Engineering and Aerospace Technology*. vol. 89, no. 4, pp: 547-557. Naples, Italy.
Available from: http://doi.org/10.1108/AEAT-11-2016-0213

NIEDERKLEINE, Marco, SCHLIEMANN, Karsten, 1999. *Erstellung einer Datenbasis mit Entwurfsdaten für Passagierflugzeuge*. Project. Hamburg, Germany: University of Applied Sciences (HAW Hamburg)
Available from: https://bit.ly/3umlBHT

NIŢĂ, Mihaela; SCHOLZ, Dieter: Estimating the Oswald Factor from Basic Aircraft Geometrical Parameters. In: Publikationen zum DLRK 2012 (Deutscher Luft- und Raumfahrtkongress, Berlin, 10. - 12. September 2012). - URN: urn:nbn:de:101:1-201212176728. DocumentID: 281424.
Download: http://OPerA.ProfScholz.de

OFR, 1962. *§1.2 Abbreviations and symbols*. Washington DC, USA: Office of Federal Register.
Availabe from: https://bit.ly/3LdOtI2
Archived at: https://perma.cc/3HWN-F94R

SAAB, 2022. Over 400 years of history. Stockholm, Sweden.
Available from: https://www.saab.com/about/history
Archived at: https://perma.cc/2MB9-A9R7

SCHOLZ, Dieter, 1999. *Flugzeugentwurf*. Hamburg University of Applied Sciences (HAW Hamburg).
Availabe from: http://HOOU.ProfScholz.de

SCHOLZ, Dieter, 2015. *Aircraft Design*. Hamburg University of Applied Sciences (HAW Hamburg):
Availabe from: http://HOOU.ProfScholz.de

SKYBRARY, 2022. *International Standard Atmosphere (ISA)*. Brussels, Belgium.
Availabe from: https://skybrary.aero/articles/international-standard-atmosphere-isa
Archived at: https://perma.cc/6ZZW-7EZF

SKYBRARY, 2022a. *Instrument Flight Rules (IFR)*. Brussels, Belgium.
Availabe from: https://skybrary.aero/articles/instrument-flight-rules-ifr
Archived at: https://perma.cc/87XZ-CB5K

SKYBRARY, 2022b. *Instrument Meteorological Conditions (IMC)*. Brussels, Belgium.
Availabe from: https://skybrary.aero/articles/instrument-meteorological-conditions-imc
Archived at: https://perma.cc/6R8G-D2D8

SKYBRARY, 2022c. *True Airspeed (TAS)*. Brussels, Belgium.
Availabe from: https://skybrary.aero/articles/true-airspeed
Archived at: https://perma.cc/FW9M-Q95V

SKYBRARY, 2022d. *Calibrated Airspeed (CAS)*. Brussels, Belgium.
Availabe from: https://skybrary.aero/articles/calibrated-airspeed-cas
Archived at: https://perma.cc/KP3N-Q4DY

SKYBRARY, 2022e. *Equivalent Airspeed (EAS)*. Brussels, Belgium.
Availabe from: https://skybrary.aero/articles/equivalent-airspeed-eas
Archived at: https://perma.cc/NX7S-XHSP

SKYBRARY, 2022f. *Indicated Airspeed (IAS)*. Brussels, Belgium.
Availabe from: https://skybrary.aero/articles/indicated-airspeed-ias
Archived at: https://perma.cc/LTG7-2EAV

SKYBRARY, 2022f. *Mach Number*. Brussels, Belgium.
Availabe from: https://skybrary.aero/articles/mach-number
Archived at: https://perma.cc/M28Y-CQTM

TEXTRON AVIATION, 2022. *Company Overview*. Wichita, Kansas, USA.
Availabe from: https://txtav.com/en/company
Archived at: https://perma.cc/K3SX-EALJ

UTAH, 2019. *Utah Tax Code*. Salt Lake City, USA: Utah State Legislature.
Available from: https://le.utah.gov/xcode/Title72/Chapter10/72-10-S102.html
Archived at: https://perma.cc/58Y3-4TC7

VIKING AIR, 2022. Mission & Profile. Sidney, British Columbia, Canada.
Available from: https://www.vikingair.com/company-careers/mission-profile
Archived at: https://perma.cc/4C2L-XJMX

WIKIPEDIA, 2022i. *Fairchild Aircraft*.
Available from: https://en.wikipedia.org/wiki/Fairchild_Aircraft
Archived at: https://perma.cc/TW2D-FUFL

WIKIPEDIA, 2022m. *Sukhoi*.
Available from: https://en.wikipedia.org/wiki/Sukhoi
Archived at: https://perma.cc/4AX6-9ZTB

WIKIPEDIA, 2022o. *Maximum takoff weight*.
Available from: https://en.wikipedia.org/wiki/Maximum_takeoff_weight
Archived at: https://perma.cc/DB9W-8G4V

List of References (Database)

AERONATICAL WORLD AIRLINERS, 2012. *Fokker 100*.
Archived at: https://bit.ly/3x0E3qj

AIRPORT COMPATIBILITY GROUP, 1990. *MD-80 Series Airplane Characteristics for Airport Planning*. Lomg Beach, USA.
Available from: https://bit.ly/3lx4Q8b
Archived at: https://perma.cc/2SVH-LLMS

AIRBUS CANADA LIMITED PARTNERSHIP, 2022. *A220 Airport planning publication APP*. Quebec, Canada.
Available from: https://bit.ly/3MO5vOk
Archived at: https://perma.cc/F2LS-S2KX

AIRBUS, 2020. *A380 Aircraft Characteristics Airport and Maintenance Planning*. Blacnac, France.
Available from: https://bit.ly/3wzQ0Ea
Archived at: https://perma.cc/3FGC-XYHT

AIRBUS, 2021. *A330 Aircraft Characteristics Airport and Maintenance Planning*. Blacnac, France.
Available from: https://bit.ly/3wzPgiw
Archived at: https://perma.cc/F5TQ-TTAM

AIRBUS, 2021. *A350 Aircraft Characteristics Airport and Maintenance Planning*. Blacnac, France.
Available from: https://bit.ly/3PEeync
Archived at: https://perma.cc/45G3-CH5T

AIRBUS, 2021. *A380 Facts & Figures*. Blacnac, France.
Available from: https://bit.ly/3sO3euW
Archived at: https://perma.cc/H7UU-YKZR

AIRBUS, 2022. *A220-300*. Blacnac, France
Available from: https://aircraft.airbus.com/en/aircraft/a220/a220-300
Archived at: https://perma.cc/RPP8-28NR

AIRBUS, 2022. *A319 Aircraft Characteristics Airport and Maintenance Planning*. Blacnac, France.
Available from: https://bit.ly/3MDH86a
Archived at: https://perma.cc/22JJ-DBHX

AIRBUS, 2022. *A319ceo*. Blacnac, France
Available from: https://aircraft.airbus.com/en/aircraft/a320/a319ceo
Archived at: https://perma.cc/6HFM-K2M6

AIRBUS, 2022. *A320 Aircraft Characteristics Airport and Maintenance Planning*. Blacnac, France.
Available from: https://bit.ly/38IAahh
Archived at: https://perma.cc/LW3P-QKTT

AIRBUS, 2022. *A320ceo*. Blacnac, France
Available from: https://aircraft.airbus.com/en/aircraft/a320/a320ceo
Archived at: https://perma.cc/7JPW-AHS6

AIRBUS, 2022. *A321 Aircraft Characteristics Airport and Maintenance Planning*. Blacnac, France.
Available from: https://bit.ly/3LveH8V
Archived at: https://perma.cc/YNM4-WAA5

AIRBUS, 2022. *A321ceo*. Blacnac, France
Available from: https://aircraft.airbus.com/en/aircraft/a320/a321ceo
Archived at: https://perma.cc/VM7P-3CQK

AIRBUS, 2022. *A321neo*. Blacnac, France
Available from: https://aircraft.airbus.com/en/aircraft/a320/a321neo
Archived at: https://perma.cc/DTH6-3JQW

AIRBUS, 2022. *A330-200*. Blacnac, France
Available from: https://aircraft.airbus.com/en/aircraft/a330/a330-200
Archived at: https://perma.cc/N2U9-E2H3

AIRBUS, 2022. *A330-300*. Blacnac, France
Available from: https://aircraft.airbus.com/en/aircraft/a330/a330-300
Archived at: https://perma.cc/6FNR-XS8L

AIRBUS, 2022. *A330-900*. Blacnac, France
Available from: https://aircraft.airbus.com/en/aircraft/a330/a330-900
Archived at: https://perma.cc/VR2U-YQPN

AIRBUS, 2022. *A350-1000*. Blacnac, France
Available from: https://aircraft.airbus.com/en/aircraft/a350/a350-1000
Archived at: https://perma.cc/4ZWY-69WP

AIRBUS, 2022. *A350-900*. Blacnac, France
Available from: https://aircraft.airbus.com/en/aircraft/a350/a350-900
Archived at: https://perma.cc/TF4F-L6ET

AIRBUS, 2022. *ACJ neo*. Blacnac, France
Available from: https://www.acj.airbus.com/en/exclusive-aircraft/acjneo
Archived at: https://perma.cc/A3L5-DZ5F

ALLIANCE AIRLINERS, 2019. *Fokker 50*. Eagle Farm, Australia.
Available from: https://bit.ly/3MB2xN7
Archived at: https://perma.cc/2EJB-BSB7

AMELIA, 2022. *Beechcraft 1900C*. Paris, France.
Available from: https://bit.ly/3PC1SNB
Archived at: https://perma.cc/U7NB-R8BP

ANTONOV, 2022. *AN-24*. Kyiv, Ukraine.
Available from: https://www.antonov.com/en/history/an-24
Archived at: https://perma.cc/2XEH-U23Y

ATR, 1995. *ATR 42 Airplane Flight Manual*. Blacnac, France.
Archived at: https://perma.cc/J8MY-KVDC

ATR, 2003. *ATR 72 Flight Manual*. Blacnac, France.
Archived at: https://perma.cc/UQ5K-LGE4

ATR, 2022. *ATR 42-600 Factsheet*. Blacnac, France.
Available from: https://bit.ly/3sNEvXo
Archived at: https://perma.cc/M5QY-YPJJ

ATR, 2022. *ATR 72-600 Factsheet*. Blacnac, France.
Available from: https://bit.ly/3wBkcxw
Archived at: https://perma.cc/WP38-WHA6

AVIAROS.NAROS, 2001. *AN-24*. Russia
Available from: http://aviaros.narod.ru/an-24.htm
Archived at: https://perma.cc/U3YJ-Y2KU

BAE SYSTEMS, 2022. *De Havilland Canada DHC-8 Dash 8*. London, United Kingdoms.
Available from: https://bit.ly/3sR0htv
Archived at: https://perma.cc/H3NZ-4NFS

BOEING, 1998. *777-200/300 Airplane Characteristics for Airport Planning*. Seal Beach, USA.
Available from: https://bit.ly/3lxlqok
Archived at: https://perma.cc/4GC7-EZTY

BOEING, 2002. *717-200 Technical Characteristics*. Chicago, USA.
Available from: https://bit.ly/3LF3KSm
Archived at: https://perma.cc/92XY-JDAC

BOEING, 2002. *747-400 Airplane Characteristics for Airport Planning*. Seal Beach, USA.
Available from: https://bit.ly/3wBxN96
Archived at: https://perma.cc/WEU4-Y8LA

BOEING, 2002. *757-200/300 Airplane Characteristics for Airport Planning*. Seal Beach, USA.
Available from: https://bit.ly/3yNvqSb
Archived at: https://perma.cc/SHG4-M9MS

BOEING, 2005. *717*. Chicago, USA.
Available from: https://bit.ly/3LuroB2
Archived at: https://perma.cc/Z7VQ-XMJJ

BOEING, 2014. *717-200 Airplane Characteristics for Airport Planning*. Seal Beach, USA.
Available from: https://bit.ly/3PLhezo
Archived at: https://perma.cc/8D4X-JBN8

BOEING, 2014. *777 Family Backgrounder*. Seattle, USA.
Available from: https://bit.ly/3MIAD24
Archived at: https://perma.cc/663U-FS5V

BOEING, 2015. *777-200LR/-300ER/-Freighter Airplane Characteristics for Airport Planning*. Seal Beach, USA.
Available from: https://bit.ly/3G7vtdi
Archived at: https://perma.cc/9LK4-N96A

BOEING, 2020. *737 Airplane Characteristics for Airport Planning*. Seal Beach, USA.
Available from: https://bit.ly/39K7Gnq
Archived at: https://perma.cc/T7AN-VYZC

BOEING, 2021. *737 MAX Airplane Characteristics for Airport Planning*. Seal Beach, USA.
Available from: https://bit.ly/39JvNTh
Archived at: https://perma.cc/RL4R-UBA4

BOEING, 2021. *767 Airplane Characteristics for Airport Planning*. Seal Beach, USA.
Available from: https://bit.ly/3G8cuz9
Archived at: https://perma.cc/GP69-QH73

BOEING, 2021. *787 Airplane Characteristics for Airport Planning*. Seal Beach, USA.
Available from: https://bit.ly/3PCRo08
Archived at: https://perma.cc/5UXS-VURU

BOMBARDIER INC., 1990. *DASH 8 Aricraft Recovery Manual*. Ontario, Canada.
Available from: https://bit.ly/3G4HSyC
Archived at: https://perma.cc/CKJ3-WVVC

BOMBARDIER INC., 1994. *Airport Planning Manual Series 300*. Ontario, Canada.
Available from: https://bit.ly/3PC1yyn
Archived at: https://perma.cc/M9WP-4S6F

BOMBARDIER INC., 1999. *Q100 DASH 8 Airport Planning Manual Series 100*. Ontario, Canada.
Available from: https://bit.ly/3wFImqO
Archived at: https://perma.cc/MPN3-SDHQ

BOMBARDIER INC., 2001. *Q300 DASH 8 Airport Planning Manual*. Ontario, Canada.
Available from: https://bit.ly/3Nt2Qd3
Archived at: https://perma.cc/2LDR-SKHP

BOMBARDIER INC., 2014. *Dash 8 Series 400*, Airport Planning Manual. Ontario, Canada.
Available from: https://bit.ly/38CZhlU
Archived at: https://perma.cc/XC4M-3LUC

BOMBARDIER INC., 2015. *CRJ700 Airport Planning Manual*. Ontario, Canada.
Available from: https://bit.ly/3Lyy94D
Archived at: https://perma.cc/2YTP-RDSP

BOMBARDIER INC., 2015. *CRJ900 Airport Planning Manual*. Ontario, Canada.
Available from: https://bit.ly/3yLb38m
Archived at: https://perma.cc/CBG7-XE88

BOMBARDIER INC., 2016. *Airport Planning Manual CRJ100/200/440*. Ontario, Canada.
Available from: https://bit.ly/38A4ECp
Archived at: https://perma.cc/2LBN-K7Y7

BOMBARDIER INC., 2016. *Q400 NextGen Factsheet*. Ontario, Canada.
Archived at: https://bit.ly/3afnyih

BOMBARDIER INC., 2021. *CRJ Series Brochure*. Ontario, Canada.
Archived at: https://bit.ly/3MFQePK

BUNDESSTELLE FÜR FLUGUNFALLUNTERSUCHUNGEN, 2019. *Interim Report BFU19-1422-EX Jetstream 32*. Braunschweig, Germany. Report: BFU19-1422-EX.
Available from: https://bit.ly/3LHYn56
Archived at: https://perma.cc/96CY-2RC2

DE HAVILLAND, 2021. *DASH 8-400*. Toronto, Canada.
Available from: https://dehavilland.com/en/dash-8-400
Archived at: https://perma.cc/NP7D-ZLRH

DHL INTERNATIONAL GMBH, 2022. *Beechcraft 1900C*. Bonn, Germany
Available from: https://bit.ly/3sOqBV6
Archived at: https://perma.cc/V3F7-XDQM

EASA, 2009. *Type-Certificate Data Sheet EASA IM.A.211 MD-90-30, B717-200*. Cologne, Germany.
Available from: https://www.easa.europa.eu/downloads/8159/en
Archived at: https://perma.cc/9HP7-3MVJ

EASA, 2009. *Type-Certificate Data Sheet Jetstream 3100 / 3200 Series*. Cologne, Germany.
Available from: https://www.easa.europa.eu/downloads/8171/en
Archived at: https://perma.cc/27C7-T3TU

EASA, 2009. *Type-Certificate Data Sheet No. E.023 for BR700-715 Series Engines*. Cologne, Germany.
Available from: https://www.easa.europa.eu/downloads/7757/en
Archived at: https://perma.cc/RX8K-VRYB

EASA, 2011. *Type-Certificate Data Sheet No. EASA.IM.A.001 for Embraer ERJ 170*. Cologne, Germany.
Available from: https://www.easa.europa.eu/downloads/8393/en
Archived at: https://perma.cc/F35H-8PQR

EASA, 2012. *Type-Certificate Data Sheet No. EASA.A.084 for ATR42 and ATR 72*. Cologne, Germany.
Available from: https://www.easa.europa.eu/downloads/8249/en
Archived at: https://perma.cc/LEZ5-4YDR

EASA, 2014. *Type-Certificate Data Sheet No. EASA.(IM).E.049 for PW150 series*. Cologne, Germany.
Available from: https://www.easa.europa.eu/downloads/17870/en
Archived at: https://perma.cc/RX98-GAWD

EASA, 2015. *Type-Certificate Data Sheet No. IM.A.023 for CL-600 Challenger 600 Series*. Cologne, Germany.
Available from: https://www.easa.europa.eu/downloads/8355/en
Archived at: https://perma.cc/7FN7-2RZN

EASA, 2015. *Type-Certificate Data Sheet No. IM.E.044 for AE 3007 Series Engines*. Cologne, Germany.
Available from: https://www.easa.europa.eu/downloads/7719/en
Archived at: https://perma.cc/86E4-M7YD

EASA, 2017. *Type-Certificate Data Sheet No. EASA.IM.A.575 for DHC-6 - Series*. Cologne, Germany.
Available from: https://www.easa.europa.eu/downloads/7070/en
Archived at: https://perma.cc/S5F6-FBTH

EASA, 2018. *Type-Certificate Data Sheet No. EASA.IM.A.036 for Fokker F27*. Cologne, Germany.
Available from: https://www.easa.europa.eu/downloads/8335/en
Archived at: https://perma.cc/2WMG-ZLA5

EASA, 2018. *Type-Certificate Data Sheet No. EASA.IM.A.037 for Fokker F28*. Cologne, Germany.
Available from: https://www.easa.europa.eu/downloads/7450/en
Archived at: https://perma.cc/3NHE-DMUJ

EASA, 2018. *Type-Certificate Data Sheet No. EASA.IM.A.196 for Boeing 747*. Cologne, Germany.
Available from: https://www.easa.europa.eu/downloads/7250/en
Archived at: https://perma.cc/HNW8-Z8N3

EASA, 2018. *Type-Certificate Data Sheet No. IM.E.041 for PW100 Series Engines*. Cologne, Germany.
Available from: https://www.easa.europa.eu/downloads/7725/en
Archived at: https://perma.cc/9GMZ-NNT8

EASA, 2019. *Type-Certificate Data Sheet No. EASA E.111 for Trent XWB Series Engines*. Cologne, Germany.
Available from: https://www.easa.europa.eu/downloads/7635/en
Archived at: https://perma.cc/XM2C-GR4G

EASA, 2019. *Type-Certificate Data Sheet No. IM.E.002 for GE90 Series Engines*. Cologne, Germany.
Available from: https://www.easa.europa.eu/downloads/7799/en
Archived at: https://perma.cc/Y2K5-SYQS

EASA, 2020. *Type-Certificate Data Sheet No. EASA.A.004 for Airbus A330*. Cologne, Germany.
Available from: https://www.easa.europa.eu/downloads/22146/en
Archived at: https://perma.cc/ABD6-KFLR

EASA, 2020. *Type-Certificate Data Sheet No. EASA.IM.A.003 for Boeing 777*. Cologne, Germany.
Available from: https://www.easa.europa.eu/downloads/7521/en
Archived at: https://perma.cc/QSH7-WBXS

EASA, 2020. *Type-Certificate Data Sheet No. EASA.IM.A.110 for Airbus A380*. Cologne, Germany.
Available from: https://www.easa.europa.eu/downloads/8223/en
Archived at: https://perma.cc/YH2A-WANK

EASA, 2020. *Type-Certificate Data Sheet No. EASA.IM.A.673 for CL-600 Regional Jet Series*. Cologne, Germany.
Available from: https://bit.ly/38Fx11S
Archived at: https://perma.cc/HM7H-TLKD

EASA, 2020. *Type-Certificate Data Sheet No. IM.E.021 for CF34-10E Series Engines*. Cologne, Germany.
Available from: https://www.easa.europa.eu/downloads/7761/en
Archived at: https://perma.cc/7XEJ-F8K7

EASA, 2020. *Type-Certificate Data Sheet No. IM.E.053 for CF34-8 Series Engines*. Cologne, Germany.
Available from: https://www.easa.europa.eu/downloads/18525/en
Archived at: https://perma.cc/A8MD-9G8Z

EASA, 2020. *Type-Certificate Data Sheet No. IM.E.233 for CF34-1 and CF34-3 Series Engines*. Cologne, Germany.
Available from: https://www.easa.europa.eu/downloads/65434/en
Archived at: https://perma.cc/A5GS-SC86

EASA, 2021. *Type-Certificate Data Sheet No. EASA.IM.A.0205 for Boeing 757*. Cologne, Germany.
Available from: https://www.easa.europa.eu/downloads/7246/en
Archived at: https://perma.cc/G34D-BWKG

EASA, 2021. *Type-Certificate Data Sheet No. EASA.IM.A.068 for Saab SF340A, 340B*. Cologne, Germany.
Available from: https://www.easa.europa.eu/downloads/7388/en
Archived at: https://perma.cc/MDC7-ACGU

EASA, 2021. *Type-Certificate Data Sheet No. EASA.IM.A.120 for Boeing 737*. Cologne, Germany.
Available from: https://www.easa.europa.eu/downloads/7297/en
Archived at: https://perma.cc/Q26T-AUXV

EASA, 2021. *Type-Certificate Data Sheet No. EASA.IM.A.191 for DHC-8*. Cologne, Germany.
Available from: https://www.easa.europa.eu/downloads/7257/en
Archived at: https://perma.cc/Z8QS-SFXN

EASA, 2021. *Type-Certificate Data Sheet No. EASA.IM.A.570 for BD-500 (A220 Series)*. Cologne, Germany.
Available from: https://www.easa.europa.eu/downloads/20964/en
Archived at: https://perma.cc/H9DQ-TM4E

EASA, 2021. *Type-Certificate Data Sheet No. IM.A.035 for Boeing 767*. Cologne, Germany.
Available from: https://www.easa.europa.eu/downloads/8337/en
Archived at: https://perma.cc/9UYW-SB9Z

EASA, 2021. *Type-Certificate Data Sheet No. IM.A.115 for Boeing 787*. Cologne, Germany.
Available from: https://www.easa.europa.eu/downloads/8217/en
Archived at: https://perma.cc/X53C-P5PQ

EASA, 2021. *Type-Certificate Data Sheet No. IM.E.090 for PW1500G Series Engines*. Cologne, Germany.
Available from: https://www.easa.europa.eu/downloads/20863/en
Archived at: https://perma.cc/3W2A-VWPG

EASA, 2022. *Type-Certificate Data Sheet No. EASA.IM.A.032 for Embraer EMB-145*. Cologne, Germany.
Available from: https://www.easa.europa.eu/downloads/7461/en
Archived at: https://perma.cc/GV3W-QJ29

EASA, 2022. *Type-Certificate Data Sheet No. EASA.IM.A.064 for Airbus A318-A319-A320-A321*. Cologne, Germany.
Available from: https://www.easa.europa.eu/downloads/16507/en
Archived at: https://perma.cc/4XBC-TRFE

EASA, 2022. *Type-Certificate Data Sheet No. EASA.IM.A.071 for Embraer ERJ-190*. Cologne, Germany.
Available from: https://www.easa.europa.eu/downloads/7382/en
Archived at: https://perma.cc/QGK3-YP6W

EASA, 2022. *Type-Certificate Data Sheet No. EASA.IM.A.151 for Airbus A350*. Cologne, Germany.
Available from: https://www.easa.europa.eu/downloads/17736/en
Archived at: https://perma.cc/UMN7-B3SP

EASA, 2022. *Type-Certificate Data Sheet No. EASA.IM.A.188 for EMB-120*. Cologne, Germany.
Available from: https://www.easa.europa.eu/downloads/127185/en
Archived at: https://perma.cc/D2BN-AX8X

EMBRAER S.A., 2010. *Embraer 195*. São José dos Campos, Brazil.
Archived at: https://bit.ly/3lwyxGl

EMBRAER S.A., 2013. *Embraer 190*. São José dos Campos, Brazil.
Archived at: https://bit.ly/3yRwjsZ

EMBRAER S.A., 2015. *Embraer 175 Airport Planning Manual*. São José dos Campos, Brazil.
Available from: https://bit.ly/3yRnUG3
Archived at: https://perma.cc/EDT7-FN69

EMBRAER S.A., 2016. *Embraer 170/175 Airplane Operations Manual Volume 1*. São José dos Campos, Brazil.
Available from: https://bit.ly/3LB0pDN
Archived at: https://perma.cc/7RET-BU72

EMBRAER S.A., 2019. *EMB120 Brasilia Airport Planning Manual*. São José dos Campos, Brazil.
Available from: https://bit.ly/3G5ec4z
Archived at: https://perma.cc/PVJ9-RBCE

EMBRAER S.A., 2019. *EMB145 Airport Planning Manual*. São José dos Campos, Brazil.
Available from: https://bit.ly/3wyDGUE
Archived at: https://perma.cc/K4CR-9JGT

EMBRAER S.A., 2021. *Embraer 170 Airport Planning Manual*. São José dos Campos, Brazil.
Available from: https://bit.ly/3Pv35pX
Archived at: https://perma.cc/MD4G-J8TY

EMBRAER S.A., 2021. *Embraer 190 Airport Planning Manual*. São José dos Campos, Brazil.
Available from: https://bit.ly/3wB3z6v
Archived at: https://perma.cc/V2KU-X446

EMBRAER S.A., 2021. *Embraer 195 Airport Planning Manual*. São José dos Campos, Brazil.
Available from: https://bit.ly/3NvyyWS
Archived at: https://perma.cc/H4U6-YB2D

EMBRAER S.A., 2022. *ERJ145XR*. São José dos Campos, Brazil.
Available from: https://www.embraercommercialaviation.com/commercial-jets/erj145xr/
Archived at: https://perma.cc/E84W-GP4L

EMIRATES, 2022. *Die Emirates Boeing 777*. Dubai, United Arabian Emirates.
Available from: https://www.emirates.com/de/german/experience/our-fleet/boeing-777/
Archived at: https://perma.cc/2KHQ-NEL7

EVERTS AIR, 2010. *EMB 120 Maintenance Manual*. Fairbanks, USA.
Archived at: https://perma.cc/J2B6-ATB5

FAA, 1997. *Type Certificate Data Sheet A8SW*. Washington DC, USA.
Available from: https://man.fas.org/dod-101/sys/ac/docs/a8sw.pdf
Archived at: https://perma.cc/2YG9-KR3L

FAA, 1998. *Type Certificate Data Sheet A2NM*. Washington DC, USA.
Available from: https://man.fas.org/dod-101/sys/ac/docs/a2nm.pdf
Archived at: https://perma.cc/6QNP-GDQQ

FAA, 2001. *Type Certificate Data Sheet No. A6WE*. Washington DC, USA.
Available from: https://bit.ly/3MA7Fkx
Archived at: https://perma.cc/8ZK4-AYQE

FAA, 2006. *Type Certificate Data Sheet No. T00011AT*. Washington DC, USA.
Available from: https://bit.ly/3sOfRGj
Archived at: https://perma.cc/B2QA-LR93

FAA, 2007. *Type Certificate Data Sheet No. A14CE*. Washington DC, USA.
Available from: https://bit.ly/3wzfr8T
Archived at: https://perma.cc/EGS6-A8D6

FAA, 2007. *Type Certificate Data Sheet No. A1NM*. Washington DC, USA.
Available from: https://bit.ly/39HUEan
Archived at: https://perma.cc/9KB2-NTKQ

FAA, 2010. *Type Certificate Data Sheet No. E9NE*. Washington DC, USA.
Available from: https://bit.ly/3LudA9G
Archived at: https://perma.cc/V9E3-Q7VU

FAA, 2015. Type Certificate Data Sheet No. A20WE. Washington DC, USA.
Available from: https://bit.ly/3wyKWQi
Archived at: https://perma.cc/3LZA-VAWR

FAA, 2015. *Type Certificate Data Sheet No. A5SW*. Washington DC, USA.
Available from: https://bit.ly/3LyG7Lm
Archived at: https://perma.cc/3DCB-RBAQ

FAA, 2018. *Type Certificate Data Sheet No. A16WE*. Washington DC, USA.
Available from: https://bit.ly/39HD1Ye
Archived at: https://perma.cc/LW7V-MJ9J

FAA, 2018. *Type Certificate Data Sheet No. A24CE*. Washington DC, USA.
Available from: https://bit.ly/3afV9IW
Archived at: https://perma.cc/BYP3-FK4M

FAA, 2021. *Type Certificate Data Sheet No. T00001SE*. Washington DC, USA.
Available from: https://bit.ly/38Fixix
Archived at: https://perma.cc/H6SJ-WRUZ

FLAIG, Axel, 2008. *Airbus A380: Solutions to the Aerodynamic Challenges of Designing the World's Largest Passenger Aircraft*. Hamburg, Germany
Available from: https://bit.ly/3yR4y3F
Archived at: https://perma.cc/XSP5-42G2

FLIGHTGLOBAL, 2020. *World Airliner Census 2020*. Sutton, United Kingdom
Available from: https://www.flightglobal.com/download?ac=73559
Archived at: https://perma.cc/R3L2-3CJB

FOKKER SERVICES B.V., 2009. *Fokker 100*. Nieuw-Vennep, The Netherlands.
Archived at: https://bit.ly/39HEv4s

FOKKER SERVICES B.V., 2022. *Fokker 100 Information Booklet*. Nieuw-Vennep, The Netherlands.
Available from: https://bit.ly/3wyDXa8
Archived at: https://perma.cc/9KNL-FWRE

FOKKER SERVICES B.V., 2022. *Fokker 50 Information Booklet*. Nieuw-Vennep, The Netherlands.
Available from: https://bit.ly/3G8oj8P
Archived at: https://perma.cc/E9PY-43BS

GLOBALAIR, 2022. *British Aerospace Jetstream 32*. Louisville, USA.
Available from: https://www.globalair.com/aircraft-for-sale/Specifications?specid=849
Archived at: https://perma.cc/DP7N-YBDT

MHI RJ AVIATION ULC, 2020. *CRJ700 Factsheet*. Boisbriand, Canada.
Available from: https://bit.ly/3853K0a
Archived at: https://perma.cc/U6V5-ZVSP

MHI RJ AVIATION ULC, 2020. *CRJ900 Factsheet*. Boisbriand, Canada.
Available from: https://bit.ly/3Pt3Qj4
Archived at: https://perma.cc/ETY7-5HMB

MODERN AIRLINERS, 2022. *Airbus A380 Specs*.
Available from: https://modernairliners.com/airbus-a380/airbus-a380-specs/
Archived at: https://perma.cc/7FN3-NA3N

MORICHON, Lucie, 2006. *Selected Statistics in Aircraft Design*. Project. Hamburg, Germany: University of Applied Sciences (HAW Hamburg)
Available from: https://www.fzt.haw-hamburg.de/pers/Scholz/arbeiten/TextMorichon.pdf
Archived at: https://perma.cc/8WMX-78BN

PALT, Carsten, 2019. *Beechcraft 99 Airliner*. Leipzig, Germany.
Available from: http://www.flugzeuginfo.net/acdata_php/acdata_beech_99_en.php
Archived at: https://perma.cc/U6BT-E3W9

RAYTHEON TECHNOLOGIES, 2012. *Specification and Performance Beechcraft 1900D Passenger*. Sydney, Australia.
Archived at: https://bit.ly/3LzvDeK

SAAB, 2005. *Saab 340 Airplane Characteristics for Airport Planning*. Linköping, Sweden.
Archived at: https://perma.cc/UVV9-E9EE

SAAB, 2005. *Saab 340 Maintenance Planning Document*. Linköping, Sweden.
Archived at: https://perma.cc/AKV8-BKHE

SAAB, 2009. *Saab 340B/Bplus*. Linköping, Sweden.
Available from: https://www.saabaircraftleasing.com/prod/datasheets/340b_jar.pdf
Archived at: https://perma.cc/YW83-MMHG

SAAB, 2020. *Saab 340 The Versatile Turboprop*. Linköping, Sweden.
Available from: https://www.saabaircraftleasing.com/prod/dataSheets/340Brochure.pdf
Archived at: https://perma.cc/NST3-HZM7

SUPERJET INTERNATIONAL, 2011. *SUKHOISUPERJET100 Datasheet*. Venice, Italy.
Available from: https://bit.ly/3Nwwdv9
Archived at: https://perma.cc/EL9H-W878

SUPERJET INTERNATIONAL, 2016. *SUKHOISUPERJET100*. Venice, Italy.
Available from: https://bit.ly/3sLMZys
Archived at: https://perma.cc/S2UG-5NN3

TAYLOR, John W.R., 1974. *Jane's All The World's Aircraft 1974–75*. London: Jane's Yearbooks.
Archived at: https://bit.ly/3wvUhZf

URGA, 2021. *An-24RV aircraft*. Kropyvnytskyi, Ukraine.
Available from: https://urga.com.ua/en/samolet-an-24.html

VIKING AIR, 2018. *Twin Otter Series 400*. Sidney, Canada.
Available from: https://bit.ly/3yV6NDc
Archived at: https://perma.cc/K98G-FGNG

VIKING AIR, 2022. *Twin Otter Technical Specification*. Sidney, Canada.
Available from: https://www.vikingair.com/twin-otter-series-400/technical-description
Archived at: https://perma.cc/RM58-CHGV

WIKIPEDIA, 2021. *Beechcraft Model 99*.
Available from: https://de.wikipedia.org/wiki/Beechcraft_Model_99
Archived at: https://perma.cc/RK8S-6XV7

WIKIPEDIA, 2022. *Airbus A380*.
Available from: https://en.wikipedia.org/wiki/Airbus_A380
Archived at: https://perma.cc/G5JS-SJ9U

WIKIPEDIA, 2022. *Fokker 50*.
Available from: https://en.wikipedia.org/wiki/Fokker_50
Archived at: https://perma.cc/Q3SS-BTWD