The Pilot's Guide

Review - General knowledge - Interview preparation

Valerio Francati

IBN Editore

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Preface

This book has been written and published as a guide suitable for pilots seeking a review or an interview preparation, students studying for the achievement of flight licences (EASA Airline Transport Pilot Licence, Commercial Pilot Licence and Private Pilot Licence) and all flight enthusiasts looking for a general aeronautical knowledge.

The main aeronautical subjects are explained in 12 major chapters, easy to read and understand, with more than 80 illustrations and 100 technical quiz.
This guide also includes a pilot CV and a cover letter samples, in addition to general and technical interview questions, in order to prepare your assessment.
There are also a Complete V-speeds list, quick mental calculations and other tips

The contents of this book cannot replace main aviation textbooks, which retain their essential for proper and thorough preparation in the field of aviation.

The author disclaims any responsibility or liability whenever direct or indirect as to the currency, accuracy or quality of the information, nor for any consequence of its use.

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MULTIPLES AND SUBMULTIPLES

Prefix	Symbol	Numerical and exponential
yocto	y	0,000 000 000 000 000 000 000 001 = 10^{-24}
zepto	z	0,000 000 000 000 000 000 001 = 10^{-21}
atto	a	0,000 000 000 000 000 001 = 10^{-18}
femto	f	0,000 000 000 000 001 = 10^{-15}
pico	p	0,000 000 000 001 = 10^{-12}
nano	n	0,000 000 001 = 10^{-9}
micro	µ	0,000 001 = 10^{-6}
milli	m	0,001 = 10^{-3}
centi	c	0,01 = 10^{-2}
deci	d	0,1 = 10^{-1}
		1
deka	da	10 = 10^{1}
hecto	h	100 = 10^{2}
kilo	k	1000 = 10^{3}
mega	M	1000 000 = 10^{6}
giga	G	1000 000 000 = 10^{9}
tera	T	1000 000 000 000 = 10^{12}
peta	P	1000 000 000 000 000 = 10^{15}
exa	E	1000 000 000 000 000 000 = 10^{18}
zetta	Z	1000 000 000 000 000 000 000 = 10^{21}
yotta	Y	1000 000 000 000 000 000 000 000 = 10^{24}

CONVERSIONS

Distance

1 NM = 1,852 km = 6076 ft = 2025 yd

1 km = 0,54 NM = 3280 ft = 1093,61 yd

1 m = 3,28 ft = 39,36 in = 1,09 yd

1 ft = 0,3048 m = 12 in = 0,3333 yd

1 in = 2,54 cm = 0,08333 ft = 0,02777 yd

1 yd = 91,44 cm = 3 ft = 36 in

Speed

1 kt = 1 NM/h = 1,852 km/h = 101,3 ft/min = 1,15 mph

1 mph = 1,609 km/h = 88 ft/min = 0,869 kt

1 m/sec = 3,6 km/h = 1,94 kt = 197 ft/min = 2,24 mph

1 ft/min = 0,009 kt = 0,018 km/h = 0,011 mph

Weight

1 kg = 2,2 lb = 35 oz = 9,81 N

1 lb = 0,454 kg = 16 oz = 4,45 N

1 oz = 0,027 kg = 0,0625 lb = 0,278 N

1 N = 0,102 kg = 3,597 oz

Volume

1 USG = 0,833 IG = 3,785 lt = 8 pt = 4 qt

1 IG = 1,2 USG = 4,545 lt = 9,6 pt = 4,8 qt

1 kg/cm^2 = 10000 kg/m^2 = 0,967 atm = 735,5 mm Hg = 0,981 bar

1 kg/m^2 = 9,81 Pa = 1 mm H_2O

Pressure

1 hPa = 1 mbar = 0,001 bar = 0,000987 atm = 10,19 kg/m^2 = 0,0145 lb/in^2 = 0,0295 inHg = 0,75 mmHg

1 bar = 1000 hPa = 1000 mbar = 0,987 atm = 1,019 kg/cm^2 = 14,5 lb/in^2 = 29,53 inHg = 750 mmHg

1 atm = 1,013 bar = 1013,25 hPa = 1,033 kg/cm^2 = 14,696 lb/in^2 = 29,92 inHg = 760 mmHg

1 kg/cm^2 = 0,98 bar = 980 hPa = 0,967 atm = 14,22 lb/in^2 = 28,959 inHg = 735,57 mmHg

1 lb/in^2 = 1 psi = 0,0689 bar = 0,068 atm = 68,9 hPa = 703 kg/m^2 = 2,035 inHg = 51,72 mmHg

1 mmHg = 0,00133 bar = 1,333 hPa = 0,0013 atm = 13,595 kg/m^2 = 0,0193 lb/in^2 = 0,0393 inHg

1 inHg = 0,03386 bar = 33,86 hPa = 0,0334 atm = 345,316 kg/m^2 0,49 lb/in^2 = 25,4 mmHg

Area

1 m^2 = 1550 in^2 = 10,75 ft^2 = 1,196 yd^2

1 in^2 = 6,45 cm^2 = 0,00694 ft^2 = 0,000772 yd^2

1 ft^2 = 0,0929 m^2 = 144 ft^2 = 0,11111 yd^2

1 yd^2 = 0,835 m^2 = 1296 in^2 = 9 ft^2

Power

1 hp = 735,5 W = 735,5 VA

1 W = 1 VA = 0,00136 hp

1 VA = 1 W = 0,00136 hp

Energy

1 kWh = 860 kcal = 3600 kJ

1 kcal = 0,00115 kWh = 4184 J = 4,184 kJ

1 kJ = 0,2777 Wh = 0,239 kcal

1 cal = 0,001 kcal = 0,00115 Wh = 4,184 J

Angle

1° = 1,745% = 1,1111 gon = 0,0174 rad = 60' = 3600"

1 rad = 57,296° = 63,662 gon = 3437,75' = 206265"

1% = 0,573° = 0,009999 rad = 0,6365 gon = 34,375' = 2062,58"

1 gon = 0,9° = 1,57% = 0,0157 rad = 54' = 3240"

1' = 60" = 0,01666° = 0,029% = 0,00029 rad = 0,0185 gon

1" = 0,01666' = 0,0002777° = 0,000485% = 0,0003085 gon

Time

1 s = 0,0166667 min = 0,000277778 h

1 min = 60 s = 0,0166667 h = 0,000694444 d

1 h = 3600 s = 60 min = 0,0416667 d

1 d = 86400 s = 1440 min = 24 h

Temperature

1 °C = 33,8 °F = 274,15 K = 493,47 °Ra

1 °F = -17,22 °C = 255,8 K = 460,67 °Ra

1 K = -272,15 °C = -457,87 °F = 1,8 °Ra

1 °Ra = -272,58 °C = -458,67 °F = 0,5555 K

CONVERSION FACTORS

To convert	Into	Multiply by
°C	°F	1,8 and add 32
°F	°C	Subtract 32 and Multiply by 0,555
cm	in	0,394
cm^2	in^2	0,155
cm^3	in^3	0,061
ft	m	0,304
g	oz	0,035
hp	kW	0,74
IG	USG	1,2
IG	lt	4,546
in	cm	2,54
in^2	cm^2	6,452
in^3	cm^3	16,38
kg	lb	2,204
km	NM	0,539
km	SM	0,621
km^2	NM^2	0,386
kPa	lbf/in^2	0,145
kt	MPH	1,151
kW	hp	1,34
lb	kg	0,453
lbf	N	4,45
lbf/in^2	kPa	6,895
lt	USG	0,264
lt	IG	0,22
m	ft	3,281
m	yd	1,094
m^2	yd^2	1,196
MPH	kt	0,868
N	lbf	0,225
NM	km	1,852
NM	m	1852

NM	SM	1,151
NM^2	km^2	2,59
oz	g	28,35
SM	km	1,868
SM	NM	0,868
USG	IG	0,833
USG	lt	3,785
yd	m	0,914
yd^2	m^2	0,836

MENTAL MATH AND RULES OF THUMB

No official use
This are all approximations, they do not replace proper formulas and precise measurements

1 NM = 1,852 km = multiply by 2 and subtract 10%

1 kt = 1 NM/h = 1,852 km/h = multiply by 2 and subtract 10%

$°C = (°F - 32) \cdot \frac{5}{9} = (°F - 30) / 2$

$°F = (°C \cdot \frac{9}{5}) + 32 = (2 \cdot °C) + 30$

$°C = K - 273$

$K = °C + 273$

ISA = FL · 2 - 15 °C (below FL200)/- 16 °C (above FL200) = [°C]
FL100
ISA = 10 · 2 - 15 = - 5 °C

TAS = (FL · 2) + IAS = [kt]
FL80 IAS = 120 kt
TAS = (8 · 2) + 120 = 136 kt

TAS = M · 6 = [kt]
M = 0.71
TAS = 0.71 · 6 = 420 kt

GS = M · 10 = [NM/min]
M = 0.71
GS = 0.71 · 10 = 7,1 NM/min

Start level off = FL - Δft = [ft]
Δft = VS (ft/min) · 10%
Climbing to FL110 VS = 1000 ft/min
Δft = 1000 · 10% = 100 ft
Start level off = 11000 - 100 = 10900 ft

Vertical speed error = 2 · Δft = [ft/min]
Altitude = 4200 ft instead 4000 ft
Vertical speed = 200 · 2 = 400 ft/min

Bank required (3°/sec) = 10%TAS + ($\frac{10\%TAS}{2}$) = [°]
TAS = 160 kt
Bank = 10% of 160 + (10% of 160) / 2 = 24°

Radius of turn (3°/sec)
Rate = $\frac{TAS\ [kt]}{200}$ = [°/NM] (Light aircraft)
Rate = $\frac{TAS\ [kt]}{100}$ = [°/NM] (maximum bank angle 25° or 1% of GS)

Lead radial to intercept an assigned radial = Start turning point (90° intercept angle) = $\frac{60\ [NM]}{DME\ Distance\ from\ the\ satation\ [NM]}$ · Radius of turn

Wind Component
0° = Xwc 0% - Hwc 100%
30° = Xwc 50% - Hwc 90%
45° = Xwc 70% - Hwc 70%
60° = Xwc 90% - Hwc 50%
90° = Xwc 100% - Hwc 0%

Wind Correction Angle (WCA) with TAS = WCA = $\frac{Xwc\ [kt]}{TAS\ [NM/min]}$ = [°]
TAS = 120 kt CH = 340° W/V = 010°/12 kt
Xwc = 6 kt
WCA = 6 / 2 = 3°

Wind Correction Angle (WCA) with M = WCA = $\frac{Xwc\ [kt]}{Mach\ number}$ = [°]
M = 0.71
Xwc = 21 kt
WCA = 21 / 7,1 = 3°

Top of Descent (TOD) = TOD = (ΔFL · 3) + DECELERATION + W/V = [NM]
FL150 down to 2000 ft Deceleration aircraft = 1 NM
ΔFL = 15000 - 2000 = 13000
TOD = (13 · 3) + 1 = 40 NM

Climb Gradient to Climb Rate = From ft/NM to ft/min
GS = 180 kt 300 ft/NM
GS / 2 = 3
3 · 300 = 900 ft/min

Glide Path in % = From % to ° for glide path = $\frac{10 \cdot \text{Degrees [°]}}{6}$ = [%]
3° Glide Slope = 30 / 6 = 5%

Glide Path 3° = Vertical Speed 3° = $\frac{GS}{2} \cdot 10$ = [ft/min]
GS = 120 kt
Vertical Speed = (120 / 2) · 10 = 600 ft/min

Vertical speed with No Glide Path = GS · % = [ft/min]
TAS = 120 kt Glide = 4%
Vertical speed = 120 · 4 = 480 ft/min

Visual Descent Point (VDP) = Visibility = 6 · MDA = [m]
MDA = 420 ft
Visibility = 6 · 420 = 2520 m

Dynamic hydroplaning/aquaplaning = $V_p = 9 \cdot \sqrt{\text{Tyre pressure [psi]}}$ = [kt]
The speed at which dynamic hydroplaning will occur
Tyre = 87 psi
$V_p = 9 \cdot \sqrt{87}$ = 84 kt

Altimeter correction for non-standard pressure and temperature = From HIGH to LOW, look below. From LOW to HIGH, you are okay.
1 mbar = 27 ft

Turning error compass:
OSUN = Overshoot South, Undershoot North.
ANDS = Accelerate South, Decelerate North.

Best range jet aircraft = 1,32 · V_{imd}

Take-off distance increases 15% for each 1000 ft Density Altitude (DA) above sea level.

Intercepting NDB (**QDR** and **QDM**): Push the head and pull the tail of the bearing pointer (needle).

Rate 1 turn = 180°/min = 3°/sec
Rate 2 turn = 360°/min = 6°/sec
Rate 3 turn = 540°/min = 9°/sec

Speed table 1/60

Speed [kt]	Speed Number (Speed / 60)
60	1
90	1,5
120	2
150	2,5
180	3
210	3,5
240	4
270	4,5
300	5
330	5,5
360	6
390	6,5
420	7
450	7,5
480	8
510	8,5
540	9
570	9,5
600	10

FORMULAS

CC = TC - (±VAR) - (±DEV) = MC - (±DEV)

Centre of Gravity = CG = $\frac{\text{Total Moment}}{\text{Total Mass}}$

CH = MH - (±DEV) = TH - (±VAR) - (±DEV)

C_{qnh} = (QNH - 1013,25) · 27 = [ft]

D = $\frac{T \cdot V}{60}$ = [NM]

DA = PA + (118,8 · ΔISA) = [ft]

Departure = Change of Longitude (‘) · cos Lat = [NM]

ETP = PET = $\frac{D \cdot GSh}{GSo + GSh}$ = [NM]

ISA = - $\frac{2}{1000}$ · PA + 15/16 = [°C]

LSS = 38,94 · $\sqrt{\text{Absolute temperature}}$

Load Factor = n = $\frac{1}{\cos \text{ Bank Angle } (\varphi)}$

M = F · b

MC = TC - (±VAR)

MH = TH - (±VAR) = CH + (±DEV)

M = $\frac{TAS}{LLS}$

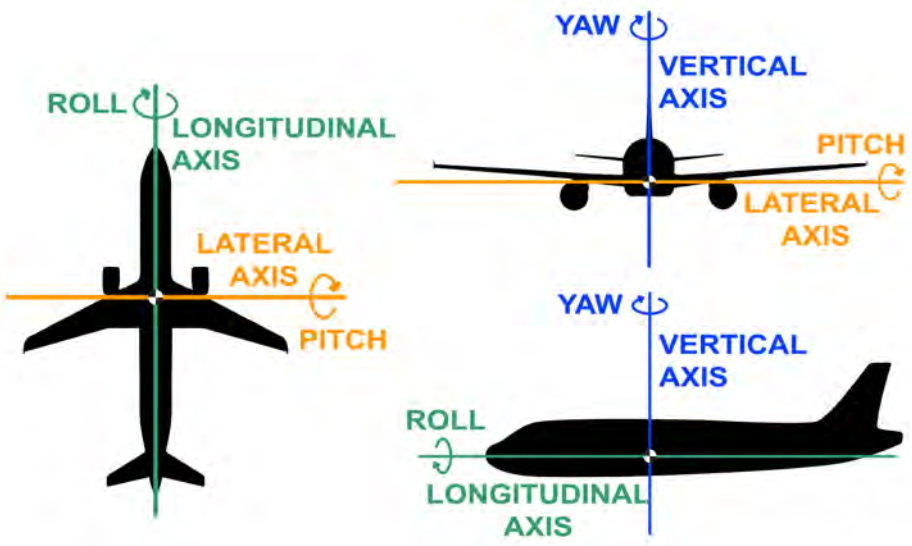
FLIGHT CONTROLS

Aircraft axes

Longitudinal axis (Roll axis): The line that passes from the nose to the tail of the aircraft.
Lateral axis (Pitch axis): The line that passes from the wing tip to the other wing tip.
Vertical axis (Yaw axis): The line that passes from underside fuselage to the top of the aircraft.

For manoeuvring and turning an aircraft, the pilot uses the primary control surfaces known as: aileron (rolling), elevator (pitching) and rudder (yawing).

Roll: The rotation around the aircraft longitudinal axis. Roll is controlled by the ailerons.
Pitch: The rotation around the aircraft lateral axis. Pitch is controlled by the elevator.
Yaw: The rotation around the aircraft vertical axis. Yaw is controlled by the rudder.



Adverse yaw

Adverse yaw is a secondary effect due to the drag caused by the ailerons deflection.
The downward-deflected aileron causes an increase in lift but it also causes an increase in induced drag, whereas the upward-deflected aileron produces the opposite effect so it causes a decrease in induced drag.
This difference in drag causes a yawing movement, which is opposite to the rolling of the aircraft.

Adverse roll

Adverse roll is a secondary effect due to the rudder of the aircraft.
During yaw there is an increase in relative wind speed on the forward-going wing which produces an increase in lift, whereas on the backward-going wing there is a decrease in relative speed which produces a decrease in lift.
This difference in lift between the two wings causes a rolling movement in the direction of the turn, raising the upward-going wing.

Elevator reversal

Elevator reversal is a secondary effect due to the elevator of the aircraft.
The change of attitude of the aircraft generates an increasing (pitch up) or a decreasing (pitch down) in drag that causes a change of speed, which decreases when the elevator is used for pitch up and increases when the elevator is used for pitch down.

Load factor (n)

The load factor is the ratio between the lift force and the weight of an aircraft.

Load factor = $n = \frac{L}{W}$ Load factor in the turn = $n = \frac{1}{\cos \varphi}$

Bank Angle (φ)	Load Factor ($\frac{1}{\cos \varphi}$)	Stall Speed ($\sqrt{\text{Load Factor}}$)
0°	1,00	1,00
15°	1,04	1,02
30°	1,15	1,07
45°	1,41	1,19
60°	2,00	1,41

SYSTEMS

Landing gear

Modern aircraft are usually fitted with a retractable landing gear in order to reduce drag and improve aircraft performances.

Three common types of landing gear:

- Conventional or taildragger: Two wheels forward and a third small wheel at the tail (used for older light aircraft).
- Tricycle: Two main wheels and a nose wheel (used for light aircraft).
- Tandem: Two sets of wheels located one behind the other on the fuselage (used for large aircraft).

A manual extension on the canter pedestal allows the flight crew to extend landing gear in case of hydraulic or electric failure occurs.

Normally the landing gear consists of:

- 2 main landing gear.
- 1 nose landing gear.

Landing gear main functions:

- Support the aircraft on the ground.
- Absorb the landing load and kinetic energy.

ABBREVIATIONS AND CODES

ICAO DOC 8400 – ICAO Abbreviation and Codes

- Light [Used for TS, RA, PO, FC]
+ Heavy [Used For TS, RA, PO, FC]
A Amber
AAA Amended meteorological message
A/A Air-to-air
AAD Assigned Altitude Deviation
AAIM Aircraft autonomous integrity monitoring
AAL Above aerodrome level
ABI Advance boundary information
ABM Abeam
ABN Aerodrome beacon
ABT About
ABV Above
AC Altocumulus
ACARS Aircraft communication addressing and reporting system
ACAS Airborne collision avoidance system
ACC Area control centre
ACCID Notification of an aircraft accident
ACFT Aircraft
ACK Acknowledge
ACL Altimeter check location
ACN Aircraft classification number
ACP Acceptance
ACPT Accept or accepted
ACT Active or activated or activity
AD Aerodrome
ADA Advisory area
ADC Aerodrome chart
ADDN Addition or additional
ADF Automatic direction-finding equipment
ADIZ Air defence identification zone
ADJ Adjacent
ADO Aerodrome office
ADR Advisory route
ADS The address [to be used in AFS as a procedure signal]
ADS-B Automatic dependent surveillance - broadcast
ADS-C Automatic dependent surveillance - contract
ADSU Automatic dependent surveillance unit
ADVS Advisory service
ADZ Advise
AES Aircraft Earth station
AFIL Flight plan filed in the air
AFIS Aerodrome flight information service
AFM Yes or affirm or affirmative or that is correct
AFS Aeronautical fixed service
AFT After
AFTN Aeronautical fixed telecommunication network
A/G Air-to-ground
AGA Aerodromes, air routes and ground aids
AGL Above ground level
AGN Again
AIC Aeronautical information circular
AIDC Air traffic services interfacility data communications
AIP Aeronautical information publication
AIRAC Aeronautical information regulation and control
AIREP Air-report
AIRMET Information concerning en-route weather phenomena which may affect the safety of low-level aircraft operations
AIS Aeronautical information services
ALA Alighting Area
ALERFA Alert phase

ALPHABETICAL INDEX

Abbreviations (ICAO) 178
Absolute ceiling 34
Absolute instability 123
Absolute stability 123
Absorption 120, 148
Accelerate Stop Distance Available (ASDA) 97
Acknowledge 153
Additional Fuel 68
Adequate aerodrome 80
Adiabatic temperature lapse rate 123
Advection fog 131
Advection 120
Adverse roll 36
Adverse yaw 36
Aerodrome Control Service (TWR) 93
Aerodrome Reference Point (ARP) 96
Aerodrome Traffic Zone (ATZ) 94
Aerodrome visual signals 156
Aerodynamic forces 29
Aerofoil 27
Affirm 153, 154
Air conditioning 43
Air Traffic Control Services (ATCS) 93
Air Traffic Services (ATS) 93
Air Traffic Services Facility Notification (AFN) 117
Airborne Weather Radar (AWR) 114
Aircraft axes 35
Airman's Meteorological Information (AIRMET) 141
AIRMET decoding 142
Airspace classification 93
Airspeed Indicator (ASI) 56
Airway (AWY) 95
Alert height 63
Alerting Service (ALS) 93
Alternate Fuel 68
Altimeter 55
Amplitude (b) 146
Angle of attack (AOA, α) 28
Angle of incidence (AOI) 28
Anhedral 28
Anti-collision beacon lights 46
Anticyclones 122
Anti-icing 46
Anti-skid 41
Approach briefing 71, 72
Approach Control Service (APP) 93
Approach speed category 90
Approved 153
Aquaplaning 102
Area Control Service (ACC) 93
Area Navigation (RNAV) 115
Arrival segment 86
Aspect ratio (AR) 27
Assessment recommendations 158
Atmosphere 119
Attitude Indicator (AI) 59
Audible Frequency (AF) 147
Automatic Direction Finding (ADF) 108
Automatic Landing System (ALS) 63
Automatic Terminal Information Service (ATIS) 143
Auxiliary Power Unit (APU) 45
Aviation gasoline (AVGAS) 52
Aviation Law 75
Basic Empty Mass (BEM) 66
Beacons 111
Becoming (BECMG) 139, 141
Bergeron theory 125
Bernoulli's theorem 26
Block Fuel 67
Brakes 41
Braking action 102
Braking coefficient 102
Break break 153
Break 153
Briefing 70
Broadcast VOR (BVOR) 109
Calculated Take-Off Time (CTOT) 69
Calibrated airspeed (CAS) 57
Cancel 153
Categories of messages 153
Centre of gravity (CG) 27
Centre of pressure (CP) 27
Change Over Point (COP) 85
Check 154
Chord line 27
Circling approach 90
Clear Air Turbulence (CAT) 133
Clear ice 126
Cleared 154
Clearway (CWY) 99
Cloud types 124
Coalescence theory 125
Cockpit Voice Recorder (CVR) 65
Codes (ICAO) 178

Coffin corner....34
Cold front....127
Cold occlusion....128
Collision effect....125
Communication frequencies....150
Compass Course (CC)....106
Compass Heading (CH)....106
Compass turning errors....61
Compression ratio....49
Compression....48
Conditional instability....123
Conduction....120
Confirm....154
Contact....154
Contaminated runway....101
Contingency Fuel....68
Control Display Unit (CDU)....62
Control Zone (CTR)....94
Controller Pilot Data Link Communication (CPDLC)....118
Convection....120
Conversion factors....12
Conversions....8
Correct....154
Correction....154
Cosmic rays (UHECR)....147
Cover letter sample....161
Critical Mach number (M_{crit})....58
Cross-feed....44
CV sample....160
Cyclones....122
Damp runway....101
Decision Altitude/Height (DA/H)....88
De-icing....46
Density Altitude (DA)....55
Departure segments....83
Departure....105
Depression....122
Developing stage....131
Deviation (DEV)....105
Dew Point Lapse Rate (DPLR)....123
Diameter of the Earth....103
Diffraction....148
Dihedral....28
Direct entry....91
Direct wave....150
Direction Indicator (DI)....60
Disposable Load (DL)....67
Disregard....154
Dissipating stage....132
Distance Measuring Equipment (DME)....109
Distress (MAYDAY)....153
Doppler Navigation System (DNS)....114
Doppler VOR (DVOR)....109
Drag (D)....29, 30
Dry Adiabatic Lapse Rate (DALR)....123
Dry Operating Mass (DOM)....66
Dry runway....101
Dynamic hydroplaning....102
Earth rotation....103
Efficiency (E)....32
Electromagnetic radio wave....146
Electromagnetic spectrum....147
Electronic Engine Control (EEC)....51
Elevator reversal....36
Emergency frequencies....150
Emergency take-off briefing....71, 72
Engine Pressure Ratio (EPR)....51
Engines....48
En-route NDB (E-NDB)....107
Environmental Lapse Rate (ELR)....123
Equation of continuity....25
Equator....103
Equatorial radius....103
Equi-Time Point (ETP)....81
Equivalent airspeed (EAS)....57
European Aviation Safety Agency (EASA)....76
Exhaust....49
Extended Twin-Engine Operations (ETOPS)....81
Exterior indicator lights....46
Extra Fuel....68
Extra High Frequency (EHF)....147
Fail Operational....63
Fail Passive....63
Fight Information Service (FIS)....93
Final Approach Fix (FAF)....86
Final Approach Point (FAP)....87
Final Reserve Fuel....68
Final segment....86
First radio contact....73, 151
Flaps....37
Flight Data Recorder (FDC)....65
Flight Information Region (FIR)....95
Flight Management Computer System (FMCS)....62
Flight Management System (FMS)....62
Flight path angle (γ)....28
Flight Plan (FPL)....69
Flight planning....66
Fly-By-Wire (FBW)....45
Fog (FG)....130
Form drag....32
Formulas....18
Frequency (f)....146
From (FM)....141
Front....126
Frontal fog....131
Frontal zone....126
Frost....125
Frozen water....125
Fuel policy....68
Fuel....44, 52
Full Authority Digital Engine Control (FADEC)....51
Future Air Navigation System (FANS)....117
GAFOR codes....143
Galileo....116, 117
Gamma rays (γ)....147
Gas turbine engine....48, 49
General Aviation Forecast (GAFOR)....143
Glaze ice....126
Glideslope (GS or GP)....111
Global circulation of the air....132
Global Navigation Satellite Systems (GNSS)....116
Global Orbiting Navigation Satellite System (GLONASS)....116, 117
Global Positioning System (GPS)....116
Go ahead....154
Great circle....105
Greenwich....103
Gross Mass (GM)....67
Ground briefing....70
Ground Proximity Warning System (GPWWS)....63

Ground speed (GS) 57
Ground wave 150
Group interview 158
Gust 130
Gyroscope 59
Haze (HZ) 130
High Frequency (HF) 147
Hoar frost 126
Holding altitude 92
Holding speed 92
Holding 91
How do you read 154
Humidity 124
Hydraulics 42
Hydroplaning 102
I say again 154
ICAO alphabet 152
ICAO Annexes 75
Ice crystal effect 125
Ice protection 46
Ice 46, 126
Icing 46, 126
Ignition 48
ILS landing category 90, 112
Indicated airspeed (IAS) 57
Induced drag 32
Induction 48
Inertial Navigation System (INS) 61
Inertial Reference System (IRS) 61
Infrared (IR) 147
Initial Approach Fix (IAF) 86
Initial segment 86
Inner Marker (IM) 112
Instrument approach segments 86
Instrument Flight Rules (IFR) 78
Instrument Landing System (ILS) 110
Instrument Meteorological Conditions (IMC) 78
Instrumentation 53
Interference drag 32
Intermediate Fix (IF) 86
Intermediate segment 86
International Air Transport Association (IATA) 76
International Civil Aviation Organization (ICAO) 75
International Standard Atmosphere (ISA) 121
Interview questions 162
Isallobar 122
Isobar 122
Isobaths 122
Isoclinals 122
Isogonals 122
Isohypse 122
Isopleths 122
Isotach 122
Jet A 52
Jet A1 52
Jet B 52
Jet stream 133
Landing Distance Available (LDA) 98
Landing Fuel (LF) 67
Landing gear 40
Landing lights 46
Landing Mass (LM) 66
Lateral axis 35
Latitude (λ) 104
Lift (L) 29, 49
Load factor (n) 36
Load factor in the turn 36
Local speed of sound (LSS) 58
Localizer (LOC or LLZ) 110
Locator NDB (L-NDB) 107
Logo lights 46
Long Range Navigation (LORAN C) 115
Longitude (φ) 104
Longitudinal axis 35
Low Frequency (LF) 147
Low Visibility Take-Off (LVTO) 78
Low-level windshear (LLWS) 130
Lull 130
Mach number (M) 58
Magnetic compass 60
Magnetic Course (MC) 106
Magnetic Heading (MH) 106
Manoeuvring speed (V_a) 22, 57
Markers 111
Mass 66
Mature stage 131
Maximum Authorized Altitude (MAA) 85
Maximum camber 27
Maximum Landing Mass (MLM) 67
Maximum Structural Landing Mass (MSLM) 67
Maximum Structural Take-Off Mass (MSTOM) 66
Maximum Structural Taxi Mass (MSTM) 66
Maximum Take-Off Mass (MTOM) 66
Maximum Zero Fuel Mass (MZFM) 66
MAYDAY 153
M_{crit} 58
Mean camber line 27
Medium Frequency (MF) 147
Mental math 14
Meridians 103
METAR decoding 134
Meteorological Aerodrome Report (METAR) 134
Meteorological information for aircraft in flight (VOLMET) 143
Meteorological Optical Range (MOR) 131
Microburst 132
Microwave Landing System (MLS) 112
Middle Marker (MM) 111
Minimum control speed in the air (V_{mca}) 23, 58
Minimum control speed on the ground (V_{mcg}) 23, 58
Minimum Crossing Altitude (MCA) 85
Minimum Descent Altitude/Height (MDA/H) 89
Minimum Diverting Fuel (MDF) 68
Minimum En-route Altitude/Level (MEA/L) 84
Minimum Obstacle Clearance (MOC) 85
Minimum Obstruction Clearance Altitude (MOCA) 84
Minimum Off-Route Altitude (MORA) 84
Minimum Reception Altitude (MRA) 84
Minimum Sector Altitude (MSA) 84
Missed Approach Point (MAPt) 87
Missed approach segment 86
Missed approach 87
Mist (BR) 130
Monitor 154
Morse code 152
N_1 51
Navigation frequencies 150
Navigation lights 46
NAVSTAR 116
Negative 154

Nil Significant Weather (NSW) 139
No Significant Change (NOSIG) 139
Non Directional Beacons (NDB) 107
Nose wheel steering 41
Obstacle Clearance Altitude/Height (OCA/H) 87
Occluded front 128
Octane number 52
Offset entry 91
Omega 115
Operating Mass (OM) 66
Otto cycle 48
Out 154
Outer Marker (OM) 111
Outside Air Temperature (OAT) 46, 54
Over 154
PAN PAN 153
Parallel entry 91
Parallels 103
Period (T) 146
Personal interview 158
Pilot Flying (PF) 73
Pilot Monitoring (PM) 73
Piston engine 48
Pitch attitude 28
Pitch 35
Pitot probe 53
Point of Equal Time (PET) 81
Point of No Return (PNR) 81
Point of Safe Return (PSR) 81
Polar radius 103
Precession 59
Precipitation 125
Pressure altimeter 55
Pressure Altitude (PA) 55
Pressure distribution 27
Pressure 121
Pressurization 43
Primary control surfaces 35
Primary Surveillance Radar (PSR) 113
Prime meridian 103
Probability (PROB) 141
Profile drag 32
Propagation 148
Propeller efficiency 49
Psychological test 158
Q-codes 20
Q-corner 34
QDM 16, 20, 106, 108
QDR 16, 20, 106, 108
QFE 20, 122
QFF 20, 122
QNE 21, 82, 122
QNH 21, 82, 122
QTE 21, 106
Quasi-stationary front 129
QUJ 21, 106
Radiation fog 131
Radiation 120
Radio Altimeter (RA) 62
Radio Detection and Ranging (RADAR) 113
Radio wave 146
Radio waves spectrum 147
Rain ice 126
Ram Air Turbine (RAT) 44
Ram rise 54
Ramp Fuel 67
Read back 154, 155
Readability scale 152
Recleared 154
Reduced Vertical Separation Minima (RVSM) 80
Reflection 120, 148
Refraction 148
Relative Bearing (RB) 106
Relative humidity 124
Report 154
Request 154
Required Navigation Performance (RNP) 116
Required Time of Arrival (RTA) 118
Resolutions Advisory (RA) 64
Reverser 51
Rhumb line 105
Rigidity 59
Rime ice 126
Roger 154
Roll 35
Rubber hydroplaning 102
Runway conditions 101
Runway End Safety Area (RESA) 100
Runway turn-off lights 46
Runway Visual Range (RVR) 131
Saturated Adiabatic Lapse Rate (SALR) 123
Say again 154
Scattering 148
Secondary Surveillance Radar (SSR) 114
Semi-circular rule 79
Service ceiling 34
Services suffix 155
SIGMET decoding 142
Significant Meteorological Information (SIGMET) 141
Significant Weather Chart (SIGWX) 144
Significant Weather Chart symbology 144
Simulator check 159
Skin friction drag 32
Sky wave 150
Slant range 109
Slats 38
Slot Allocation Message (SAM) 69
Speak slower 154
Special meteorological aerodrome report (SPECI) 134
Specific Fuel Consumption (SFC) 52
Speed of light 146
Speedbrakes 39
Speeds abbreviations 22
Spoilers 38
Squawk 155
Stability of the air 123
Stall speed in the turn 36
Stall 33
Standard Arrival Route (STAR) 86
Standard communication phrases 153
Standard communication words 153
Standard Instrument Departure (SID) 83
Standby 154
Start Fuel 67
Start-up briefing 70
Static Air Temperature (SAT) 54
Static port 53
Static probe 53
Stopway (SWY) 99
Strobe lights 46

Suitable aerodrome 69, 81
Super High Frequency (SHF) 147
Surface wave 150
Swept back 28
Swept wing 28
Systems 40
TAF decoding 139
Take-off briefing 71, 72
Take-Off Distance Available (TODA) 97
Take-Off Fuel (TOF) 67
Take-off lights 46
Take-Off Mass (TOM) 66
Take-Off Run Available (TORA) 96
Tanks 44
Taxi Fuel 67, 68
Taxi lights 46
Taxi Mass (TM) 66
Tear drop entry 91
Technical interview 158
Technical questions 163
Technical quiz 164
Temperature 123
Temporary (TEMPO) 139, 141
Terminal Aerodrome Forecast (TAF) 139
Terminal Manoeuvring Area (TMA) 95
Terminal VOR (TVOR) 109
Test VOR (VOT) 109
Third Newton's law 49
Threshold markings 100
Thrust 29, 49
Thunderstorm (TS) 131
Total Air Temperature (TAT) 46, 54
Total drag 32
Total Reserve Fuel (TOTRES) 68
Touchdown 90
Traffic Advisory (TA) 64
Traffic circuit 78
Traffic Collision Avoidance System (TCAS) 64
Traffic Load (TL) 66
Transition Altitude (TA) 82
Transition layer 82
Transition Level (TL) 82
Transponder codes 156
Transponder phraseology 155
TREND 139
Trip Fuel (TF) 67, 68
Troposphere 119
True airspeed (TAS) 57
True Bearing (TB) 106
True Course (TC) 106
True Heading (TH) 106
Turbulence 129
Turn and Bank Indicator (TBI) 60
Tyres 42
Ultra High Frequency (UHF) 147
Ultraviolet (UV) 147
Upper Information Region (UIR) 95
Upper Wind and Temperature Chart (WT) 145
Urgency (PAN PAN) 153
Useful Load (UL) 67
V_a 22, 57
Variable Load (VL) 66
Variation (VAR) 105
V_{at} 22, 90
Velocity (v) 146
Verify 154
Vertical axis 35
Vertical Speed Indicator (VSI) 56
Very High Frequency (VHF) 147
Very Low Frequency (VLF) 147
V_{fe} 22, 56
VHF aviation frequencies 151
VHF Direction Finding (VDF) 106
VHF Omnidirectional Range (VOR) 108
V_{imd} 23, 32
Viscous hydroplaning 102
Visibility 131
Visible light (ROYGBV) 147
Visual Flight Rules (VFR) 77
Visual Meteorological Conditions (VMC) 77
V_{mca} 23, 58
V_{mcg} 23, 58
V_{ne} 23, 56
V_{no} 23, 56
VOLMET 143
VOR TACAN (VORTAC) 109
V_p 23, 102
V_{s0} 23, 56
V_{s1} 23, 56
V-speeds list 22
V_{yse} 24, 56
Wake turbulence separation minima 96
Wake turbulence weight 96
Warm front 127
Warm occlusion 128
Washout 28
Water states 120
Wavelength (λ) 146
Weather Radar (WXR) 114
Weight 29, 66
Wet runway 101
Wilco 154
Windshear 130
Wing and engine lights 46
Wing area (S) 27
Wing span (b) 27
Wing tip vortices 31
Words twice 154
Yaw 35
Zero Fuel Mass (ZFM) 66

GENERAL INDEX

MULTIPLES AND SUBMULTIPLES 7

CONVERSIONS 8
Distance 8
Speed 8
Weight 8
Volume 9
Pressure 9
Area 10
Power 10
Energy 10
Angle 10
Time 11
Temperature 11

CONVERSION FACTORS 12

MENTAL MATH AND RULES OF THUMB 14

FORMULAS 18

Q-CODES 20

SPEEDS 22

AERODYNAMICS 25
Equation of continuity 25

Bernoulli's theorem 26
Aerofoil and wing 27
Aerodynamic forces 29
Lift 29
Drag 30
Efficiency 32
Stall 33
Service Ceiling 34
Absolute Ceiling 34
Coffin corner or Q-corner 34

FLIGHT CONTROLS 35
Aircraft axes 35
Adverse yaw 36
Adverse roll 36
Elevator reversal 36
Load factor (n) 36
Flaps 37
Slats 38
Spoilers 38

SYSTEMS 40
Landing gear 40
Nose Wheel Steering (NWS) 41
Brakes 41
Anti-skid 41
Tyres 42
Hydraulics 42
Air conditioning and pressurization 43
Fuel and tanks 44
Ram Air Turbine (RAT) 44
Fly-By-Wire (FBW) 45
Auxiliary Power Unit (APU) 45
Ice protection 46
Exterior indicator lights 46

ENGINES 48
Engines 48

Piston engine 48
Gas turbine engine 49
Engine Pressure Ratio (EPR) and N_1 51
Full Authority Digital Engine Control (FADEC) 51
Reverser 51
Specific Fuel Consumption (SFC) 52
Aviation Fuels 52

INSTRUMENTATION 53
Pitot probe 53
Static probe 53
Outside Air Temperature (OAT) 54
Static Air Temperature (SAT) 54
Total Air Temperature (TAT) 54
Pressure altimeter 55
Density Altitude (DA) 55
Pressure Altitude (PA) 55
Vertical Speed Indicator (VSI) 56
Airspeed Indicator (ASI) 56
Manoeuvring speed (V_a) 57
Minimum control speed on the ground (V_{mcg}) 58
Minimum control speed in the air (V_{mca}) 58
Mach number (M) 58
Critical Mach number (M_{crit}) 58
Gyroscope 59
Attitude Indicator (AI) 59
Turn and Bank Indicator (TBI) 60
Direction Indicator (DI) 60
Magnetic compass 60
Inertial Navigation System (INS) 61
Inertial Reference System (IRS) 61
Flight Management System (FMS) 62
Radio Altimeter (RA) 62
Automatic Landing System (ALS) 63
Ground Proximity Warning System (GPWS) 63
Traffic Collision Avoidance System (TCAS) 64
Flight Data Recorder (FDR) 65
Cockpit Voice Recorder (CVR) 65

FLIGHT PLANNING 66
Mass/Weight definitions 66
Fuel definitions 67
Fuel policy and standard fuel planning 68
Flight Plan (FPL) 69
Calculated Take-Off Time (CTOT) 69
Slot Allocation Message (SAM) 69

BRIEFING 70
Ground briefing (before flight) 70
Start-up briefing (propeller light aircraft) 70
Take-off briefing (propeller light aircraft) 71
Emergency take-off briefing (propeller light aircraft) 71
Approach briefing (propeller light aircraft) 71
Take-off briefing (jet aircraft) 72
Emergency take-off briefing (jet aircraft) 72
Approach briefing (jet aircraft) 72
First radio contact 73
Pilots' responsibility (PF – PM) 73

AVIATION LAW 75
International Civil Aviation Organization (ICAO) 75
European Aviation Safety Agency (EASA) 76
International Air Transport Association (IATA) 76
Visual Flight Rules (VFR) 77
Visual Meteorological Conditions (VMC) 77
Traffic circuit 78
Instrument Flight Rules (IFR) 78
Instrument Meteorological Conditions (IMC) 78
Semi-circular rule 79
Reduced Vertical Separation Minima (RVSM) 80
Adequate aerodrome 80
Suitable aerodrome 81
Equi-Time Point (ETP) or Point of Equal Time (PET) 81
Point of No Return (PNR) or Point of Safe Return (PSR) 81
Extended Twin Engine Operations (ETOPS) 81
Transition Altitude (TA) 82
Transition Level (TL) 82

Transition layer 82
Standard Instrument Departure (SID) 83
Departure Segments 83
Minimum En-route Altitude/Level (MEA/L) 84
Minimum Sector Altitude (MSA) 84
Minimum Obstruction Clearance Altitude (MOCA) 84
Minimum Reception Altitude (MRA) 84
Minimum Off-Route Altitude (MORA) 84
Minimum Crossing Altitude (MCA) 85
Change Over Point (COP) 85
Maximum Authorized Altitude (MAA) 85
Minimum Obstacle Clearance (MOC) 85
Standard Arrival Route (STAR) 86
Instrument approach segments 86
Final Approach Fix (FAF) 86
Final Approach Point (FAP) 87
Missed approach 87
Missed Approach Point (MAP_t) 87
Obstacle Clearance Altitude/Height (OCA/H) 87
Decision Altitude/Height (DA/DH) 88
Minimum Descent Altitude/Height (MDA/H) 89
Circling Approach 90
Approach speed category 90
ILS landing category (ICAO) 90
Holding 91
Maximum holding speed and altitude 92
Air Traffic Services (ATS) 93
Airspace classification and ATS services (ICAO) 93
Aerodrome Traffic Zone (ATZ) 94
Control Zone (CTR) 94
Terminal Manoeuvring Area (TMA) 95
Flight Information Region (FIR) 95
Upper Information Region (UIR) 95
Airway (AWY) 95
Wake turbulence weight and separation minima 96
Aerodrome Reference Point (ARP) 96
Take-Off Run Available (TORA) 96
Take-Off Distance Available (TODA) 97
Accelerate Stop Distance Available (ASDA) 97

Landing Distance Available (LDA) 98
Clearway (CWY) 99
Stopway (SWY) 99
Runway End Safety Area (RESA) 100
Threshold markings 100
Runway conditions 101
Contaminated runway 101
Wet runway 101
Dump runway 101
Dry runway 101
Braking action 102
Hydroplaning/Aquaplaning 102

GENERAL AND RADIO NAVIGATION 103
General knowledge of the Earth 103
Meridians 103
Parallels 103
Latitude (λ) 104
Longitude (φ) 104
Great circle 105
Rhumb line 105
Variation (VAR) 105
Deviation (DEV) 105
Departure 105
VHF Direction Finding (VDF) 106
Radio guidance and direction 106
Non Directional Beacons (NDB) 107
Automatic Direction Finding (ADF) 108
VHF Omnidirectional Range (VOR) 108
Distance Measuring Equipment (DME) 109
Instrument Landing System (ILS) 110
Localizer (LOC or LLZ) – Azimuth 110
Glideslope (GS) or Glide Path (GP) – Elevation 111
Markers – Beacons 111
ILS Landing Category (ICAO) 112
Microwave Landing System (MLS) 112
Radio Detection and Ranging (RADAR) 113
Primary Surveillance Radar (PSR) 113

Secondary Surveillance Radar (SSR) 114
Weather Radar (WXR) 114
Doppler Navigation System (DNS) 114
Omega 115
Long Range Navigation (LORAN C) 115
Area Navigation (RNAV) 115
Required Navigation Performance (RNP) 116
Global Navigation Satellite System (GNSS) 116
Global Positioning System (GPS) 116
Global Orbiting Navigation Satellite System (GLONASS) 117
Galileo 117
Future Air Navigation System (FANS) 117

METEOROLOGY 119
Atmosphere 119
Heating of the atmosphere 120
Water states 120
International Standard Atmosphere (ISA) 121
Pressure 121
Cyclones 122
Anticyclones 122
Temperature 123
Adiabatic temperature lapse rate 123
Stability of the air 123
Humidity/Relative humidity 124
Cloud types 124
Precipitation 125
Frost 125
Icing 126
Front 126
Cold front 127
Warm front 127
Occluded front 128
Quasi-Stationary front 129
Turbulence 129
Windshear 130
Fog and mist 130
Meteorological Optical Range (MOR) or Visibility 131

Runway Visual Range (RVR) 131
Thunderstorm (TS) 131
Microburst 132
Global circulation of the air 132
Jet stream 133
Clear Air Turbulence (CAT) 133
Meteorological Aerodrome Report (METAR) 134
Special meteorological aerodrome report (SPECI) 134
METAR decoding 134
TREND 139
Terminal Aerodrome Forecast (TAF) 139
TAF decoding 139
Airman's Meteorological Information (AIRMET) 141
Significant Meteorological Information (SIGMET) 141
AIRMET and SIGMET decoding 142
General Aviation Forecast (GAFOR) 143
Automatic Terminal Information Service (ATIS) 143
Meteorological information for aircraft in flight (VOLMET) 143
Significant Weather Chart (SIGWX) 144
Significant Weather Chart symbology 144
Upper Wind and Temperature Chart (WT) 145

RADIOTELEPHONY AND COMMUNICATIONS 146
Radio wave 146
Electromagnetic spectrum 147
Radio waves spectrum 147
Propagation 148
Main aviation frequencies 150
VHF aviation frequencies 151
First radio contact 151
ICAO alphabet and Morse code 152
Readability scale 152
Categories of messages 153
Standard words and phrases used in radio communications 153
Services and units suffix 155
Read back 155
Transponder phraseology 155
Transponder codes 156

Aerodrome visual signals 156
Recommendations 157

PILOT PREPARATION GUIDE 158
Assessment recommendations 158
Sample – Pilot CV 160
Sample – Cover letter 161
General interview questions 162
General technical questions 163
Technical quiz 164

ABBREVIATIONS AND CODES 178

BIBLIOGRAPHY 189

ALPHABETICAL INDEX 190

GENERAL INDEX 195

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