

# CONTENTS AT A GLANCE

INTRODUCTION .....	i
CHAPTER 1: GLIDER FAMILIARIZATION .....	1
CHAPTER 2: AIRPORT FAMILIARIZATION .....	11
CHAPTER 3: AERODYNAMICS .....	23
CHAPTER 4: PERFORMANCE .....	41
CHAPTER 5: FLIGHT INSTRUMENTS AND SYSTEMS .....	53
CHAPTER 6: WEATHER FOR SOARING.....	85
CHAPTER 7: AVIATION WEATHER SERVICES .....	143
CHAPTER 8: MEDICAL FACTORS .....	169
CHAPTER 9: REGULATIONS.....	183
CHAPTER 10: FLIGHT PUBLICATIONS.....	197
CHAPTER 11: AIRSPACE .....	203
CHAPTER 12: AERONAUTICAL CHARTS AND NAVIGATION .....	213
CHAPTER 13: RADIO COMMUNICATIONS.....	239
CHAPTER 14: PERSONAL EQUIPMENT .....	259
CHAPTER 15: CROSS-COUNTRY SOARING .....	267
CHAPTER 16: AERONAUTICAL DECISION MAKING .....	295
GLOSSARY .....	305
INDEX.....	309
REVIEW QUESTIONS .....	313
ANSWER KEY .....	417



# TABLE OF CONTENTS

<b>INTRODUCTION .....</b>	<b>i</b>
<b>Using This Handbook.....</b>	<b>i</b>
<b>Aeronautical Knowledge Training Progress Record .....</b>	<b>i</b>
<b>Getting Your License.....</b>	<b>ii</b>
Prerequisites.....	ii
Procedure .....	iii
<b>The Sport of Soaring.....</b>	<b>iv</b>
Types of Lift .....	v
Types of Soaring.....	v
<b>Your Feedback .....</b>	<b>vii</b>
<b>About the Author.....</b>	<b>viii</b>
<b>CHAPTER 1: GLIDER FAMILIARIZATION .....</b>	<b>1</b>
<b>1.1 The Glider .....</b>	<b>1</b>
Wing Configurations .....	1
Tail Configurations .....	2
Tow Hook Configurations .....	3
Wheel/Skid Configurations .....	4
Glide Slope Control.....	5
Flaps .....	6
<b>1.2 Flight Manual .....</b>	<b>6</b>
Airspeeds.....	6
Minimum Equipment List .....	6
Stall/Spin Recovery Procedures .....	6
Preflight Checklist.....	6
Assembly/Disassembly Instructions .....	6
<b>1.3 Documentation.....</b>	<b>7</b>
Airworthiness Certificate .....	7
Registration Certificate.....	7
Operating Limits .....	8
Weight and Balance .....	9
<b>CHAPTER 2: AIRPORT FAMILIARIZATION .....</b>	<b>11</b>
<b>2.1 Operating Procedures .....</b>	<b>11</b>
<b>2.2 Airport Markings.....</b>	<b>11</b>
Runway Designations.....	11
Segmented Circle.....	12
Wind/Active Runway Indicators .....	13
Closed Runway .....	14
Displaced Threshold .....	14
Taxiway Lines .....	14
Hold Short Marking.....	15

Chevrons .....	16
Taxiway Signs .....	16
Runway Holding Position Signs .....	16
Runway Distance Remaining Sign.....	17
<b>2.3 Airport Lighting .....</b>	<b>17</b>
<b>2.4 Airport Traffic.....</b>	<b>18</b>
Types of Aircraft and Pilots .....	18
Looking for Traffic.....	19
Avoidance.....	19
<b>2.5 Wake Turbulence .....</b>	<b>19</b>
Vortex Generation .....	20
Vortex Strength .....	20
Vortex Behavior .....	20
Wake Turbulence Avoidance.....	21
<b>CHAPTER 3: AERODYNAMICS .....</b>	<b>23</b>
<b>3.1 Nomenclature.....</b>	<b>23</b>
Airfoil Nomenclature.....	23
Glider Axis.....	23
<b>3.2 Three Forces .....</b>	<b>24</b>
Lift.....	25
Drag .....	28
Weight .....	31
<b>3.3 Airspeed Limits .....</b>	<b>32</b>
Stall Speed.....	32
Maneuvering Speed .....	32
Rough Air Speed.....	33
Maximum Aerotow Speed .....	33
Never-Exceed Speed .....	33
<b>3.4 Turning Flight.....</b>	<b>33</b>
Forces in a Turn .....	33
Slips and Skids .....	35
<b>3.5 Load Factor .....</b>	<b>35</b>
<b>3.6 Stability .....</b>	<b>36</b>
Pitch Stability .....	36
Roll Stability .....	38
Yaw Stability .....	40
<b>CHAPTER 4: PERFORMANCE.....</b>	<b>41</b>
<b>4.1 Glide Ratio .....</b>	<b>41</b>
Determining Glide Distance.....	41
Determining Required Altitude .....	41
<b>4.2 Glider Polars .....</b>	<b>42</b>
Maximum Glide Ratio.....	43
Minimum Sink Speed.....	44
<b>4.3 Effects of Wind .....</b>	<b>44</b>

Headwind.....	45
Tailwind.....	47
Crosswind .....	47
<b>4.4 Effects of Lift/Sink .....</b>	<b>48</b>
Lift .....	48
Sink.....	48
<b>4.5 Effects of Wing Loading.....</b>	<b>50</b>
Effect of Wing Loading on Best Glide Speed .....	50
Effect of Wing Loading on Minimum Sink Speed.....	50
Effect of Wing Loading on the Polar .....	50
Altitude Lost During a Turn.....	52
 <b>CHAPTER 5: FLIGHT INSTRUMENTS AND SYSTEMS .....</b>	 <b>53</b>
<b>5.1 The Atmosphere.....</b>	<b>53</b>
Properties of the Atmosphere.....	53
The Standard Atmosphere.....	54
Measuring Pressure .....	55
<b>5.2 Primary Instruments .....</b>	<b>56</b>
Altimeter.....	56
Airspeed Indicator .....	62
Variometer.....	64
Yaw String/Inclinometer .....	66
Compass .....	67
<b>5.3 Secondary Instruments .....</b>	<b>71</b>
G-Meter.....	71
Gyroscopic Instruments .....	72
VOR.....	74
Automatic Direction Finder (ADF).....	77
<b>5.4 Other Flight Systems.....</b>	<b>79</b>
Radio .....	79
Transponder.....	79
Emergency Locator Transmitter (ELT)/Personal Locator Beacons (PLB) .....	80
Barograph.....	81
Global Positioning System .....	81
Electronic Flight Computer .....	82
Flight Recorder .....	82
Oxygen Equipment.....	82
 <b>CHAPTER 6: WEATHER FOR SOARING.....</b>	 <b>85</b>
<b>6.1 The Atmosphere.....</b>	<b>85</b>
Composition of the Atmosphere.....	85
The State of the Atmosphere .....	86
<b>6.2 Dew Point.....</b>	<b>89</b>
Dew and Frost.....	89
<b>6.3 Atmospheric Stability .....</b>	<b>89</b>
Dry Adiabatic Lapse Rate .....	89

Saturated Adiabatic Lapse Rate.....	90
Temperature/Dew-Point Convergence .....	90
Stability .....	91
<b>6.4 Clouds .....</b>	<b>91</b>
Composition .....	91
Classification According to Height Range.....	91
Classification According to Appearance.....	92
<b>6.5 Fog.....</b>	<b>95</b>
<b>6.6 Precipitation .....</b>	<b>96</b>
Rain/Drizzle/Virga .....	96
Freezing Rain/Drizzle .....	96
Ice Pellets/Hail .....	97
Snow .....	97
<b>6.7 Weather Systems .....</b>	<b>97</b>
Convection.....	97
Coriolis Effect .....	99
Mean Global Circulation Pattern.....	100
Air Mass Migration .....	101
Fronts.....	101
Cyclonic Low-Pressure Systems.....	104
The Jet Stream .....	107
<b>6.8 Describing the Weather .....</b>	<b>108</b>
Weather Maps .....	108
Satellite Photos .....	111
Radar .....	111
<b>6.9 Thermal Soaring Weather .....</b>	<b>111</b>
Thermal Structure.....	112
Thermal Lifecycle .....	115
Air Masses Conducive to Thermal Soaring .....	115
Atmospheric Soundings .....	116
Skew-T/Log-P Diagram .....	116
Determining Thermal Conditions from a Skew-T/Log-P Diagram .....	122
Indices for Predicting Thermal Strength and Cloud Levels.....	125
Thunderstorms.....	126
<b>6.10 Ridge Soaring Weather .....</b>	<b>130</b>
<b>6.11 Wave Soaring Weather.....</b>	<b>131</b>
Understanding Mountain Wave.....	131
Clouds Associated with Mountain Wave .....	135
<b>6.12 Convergence Lift .....</b>	<b>137</b>
Sea Breeze Fronts.....	137
Mountain Lee Convergence .....	138
Mountain Top Convergence .....	138
Valley Convergence .....	139
<b>6.13 Predicting Soaring Weather .....</b>	<b>139</b>
Scale and Timing of Weather Events .....	139
Sample Predictions .....	139

Practicing Forecasts.....	141
<b>CHAPTER 7: AVIATION WEATHER SERVICES .....</b>	<b>143</b>
<b>7.1 Sources of Weather Services.....</b>	<b>143</b>
Flight Service Station (FSS) and Automated Flight Service Station (AFSS) .....	143
Direct User Access Terminal Service (DUATS) .....	143
En route Flight Advisory Service (EFAS) .....	143
Transcribed Weather Broadcast (TWEB) .....	144
Automated Weather Observing System (AWOS) and Automated Surface Observation System (ASOS).....	144
<b>7.2 Weather Briefings.....</b>	<b>144</b>
Briefing Types.....	144
Obtaining a Briefing.....	145
<b>7.3 Observations.....</b>	<b>146</b>
Aviation Routine Weather Reports (METAR) .....	146
Weather Depiction Chart .....	151
Radar Summary Charts and Radar Weather Reports (SD).....	155
Pilot Weather Reports (PIREPs) .....	157
<b>7.4 Forecasts.....</b>	<b>159</b>
Terminal Aerodrome Forecast (TAF) .....	159
Aviation Area Forecast (FA) .....	161
Winds and Temperatures Aloft Forecast (FD).....	163
Significant Weather Prognostic Chart.....	164
<b>7.5 In-Flight Aviation Weather Advisories.....</b>	<b>166</b>
SIGMET.....	167
Convective SIGMET.....	167
AIRMET .....	167
<b>CHAPTER 8: MEDICAL FACTORS .....</b>	<b>169</b>
<b>8.1 Physiological Issues .....</b>	<b>169</b>
Middle Ear and Sinus Problems.....	169
Spatial Disorientation (Vertigo) .....	171
Motion Sickness.....	173
Dehydration .....	173
Heatstroke .....	174
Sunburn .....	174
Hypoxia .....	174
Hyperventilation .....	175
Decompression Sickness After Scuba Diving .....	176
G-Loading.....	176
<b>8.2 Mental Issues.....</b>	<b>177</b>
Stress .....	177
Fatigue .....	178
Anxiety.....	179
Extreme Emotion.....	179
<b>8.3 Chemicals.....</b>	<b>179</b>
Alcohol/Recreational Drugs .....	179

Medications .....	180
<b>CHAPTER 9: REGULATIONS .....</b>	<b>183</b>
<b>9.1 Definitions and Abbreviations .....</b>	<b>184</b>
<b>9.2 Maintenance Requirements .....</b>	<b>185</b>
Preventive Maintenance .....	186
Approving Return to Service .....	186
Record of Required Inspections.....	186
<b>9.3 Certification of Pilots .....</b>	<b>186</b>
Required Documents.....	186
Limitations on a Certificate .....	186
Denying or Revoking Certification for Drug and Alcohol Use .....	187
Duration of Pilot Certificates .....	187
Prerequisites for Student Pilot Certificate/Solo.....	187
Student Pilot Limitations.....	187
Prerequisites for the Knowledge Test.....	188
Prerequisites for the Practical Test.....	188
Private Pilot Limitations .....	188
Pilot Logbook .....	189
Medical Requirements .....	189
Flight Review Requirements.....	189
Recent Flight Experience .....	190
Change of Address .....	190
Tow Pilot Requirements .....	190
Certificate Issued Based on a Foreign Pilot License .....	190
<b>9.4 General Operating Rules.....</b>	<b>190</b>
Responsibility for Operation of the Aircraft.....	190
Operating Limits.....	191
Dropping Objects from Aircraft .....	191
Alcohol or Drug Use .....	191
Portable Electronic Devices.....	191
Required Preflight Actions.....	191
Seat Belt Use .....	192
Formation Flight, Operating Near Other Aircraft .....	192
Right of Way Rules.....	192
Minimum Operating Altitudes.....	192
Inspections, Maintenance, Repairs, Alterations .....	193
Required Documentation .....	193
Altimeter Settings .....	193
ATC Clearance .....	194
ATC Light Signals.....	194
Aircraft Position Lights.....	194
Oxygen Requirements.....	194
Aerobatic Flight .....	194
Glider Towing.....	195
Experimental Category Aircraft .....	195

9.5 Accident Reporting.....	196
<b>CHAPTER 10: FLIGHT PUBLICATIONS.....</b>	<b>197</b>
10.1 Federal Aviation Regulations (FARs).....	197
10.2 Aeronautical Information Manual (AIM).....	197
10.3 Notices to Airmen (NOTAMs).....	198
10.4 Airport/Facility Directory (A/FD).....	198
10.5 Advisory Circulars (ACs).....	200
<b>CHAPTER 11: AIRSPACE.....</b>	<b>203</b>
11.1 Why Have Airspace?.....	203
The Airspace Environment.....	203
11.2 Controlled Airspace.....	204
Class A Airspace.....	204
Class B Airspace.....	205
Class C Airspace.....	206
Class D Airspace.....	207
Class E Airspace.....	208
11.3 Uncontrolled Airspace.....	209
Class G Airspace.....	209
11.4 Special Use Airspace.....	210
Prohibited.....	210
Restricted.....	210
Warning.....	210
Military Operations Areas.....	210
Alert Areas.....	210
11.5 Other Airspace.....	210
Airport Advisory Areas.....	210
Military Training Routes (MTR).....	211
Temporary Flight Restrictions (TFR).....	211
Parachute Jump Areas.....	211
Published VFR Routes.....	211
Terminal Radar Service Areas (TRSA).....	211
National Security Areas.....	212
<b>CHAPTER 12: AERONAUTICAL CHARTS AND NAVIGATION.....</b>	<b>213</b>
12.1 Latitude and Longitude.....	213
Time Zones.....	214
12.2 VFR Aeronautical Charts.....	216
Sectionals.....	216
VFR Terminal Area Charts (TAC).....	217
World Aeronautical Charts (WAC).....	217
12.3 Reading Aeronautical Charts.....	218
Physical Features.....	218
Airports.....	224
Controlled Airspaces.....	227
Radio Aids to Navigation (NAVAID).....	230

Special Use Airspace .....	232
Other Airspace Areas.....	232
<b>12.4 Navigation .....</b>	<b>234</b>
Determining the Course Bearing.....	235
Determining Wind Correction Angle .....	235
Determining Time en Route.....	236
Dead Reckoning.....	237
Pilotage.....	237
Lost Procedures.....	237
<b>CHAPTER 13: RADIO COMMUNICATIONS.....</b>	<b>239</b>
<b>13.1 Radio Technique .....</b>	<b>239</b>
The Radio .....	239
Procedure.....	240
<b>13.2 Who Are You Talking To? .....</b>	<b>242</b>
Common Traffic Advisory Frequency (CTAF) .....	242
UNICOM.....	243
Air Traffic Control (ATC).....	243
Flight Service Station (FSS).....	244
En Route Flight Advisory Service (EFAS or Flight Watch) .....	244
Air Guard.....	245
<b>13.3 When to Use the Radio.....</b>	<b>245</b>
Position Reports from Other Gliders .....	245
Glider to Crew.....	245
Relay to Ground Crew .....	246
Operating Around Uncontrolled Airports .....	247
Operating Around Controlled Airports.....	250
Operating In Special Use Airspace .....	253
Obtaining Weather Reports .....	254
Flight Following.....	254
Land-Out.....	257
Lost While Airborne.....	257
Emergency Procedures .....	258
<b>CHAPTER 14: PERSONAL EQUIPMENT .....</b>	<b>259</b>
<b>14.1 Attire for Flying.....</b>	<b>259</b>
Hat .....	259
Sunglasses.....	259
Clothing.....	259
Shoes.....	260
<b>14.2 Food and Water.....</b>	<b>260</b>
Water .....	260
Food .....	260
<b>14.3 Parachutes.....</b>	<b>260</b>
Parachute Storage .....	261
Parachute Preflight Inspection .....	261

Parachute Fitting .....	263
Bail-Out Procedure.....	263
<b>14.4 Survival Kit.....</b>	<b>264</b>
Food and Water .....	265
Shelter .....	265
Medical Concerns.....	265
Signaling/ Communications .....	265
Miscellaneous.....	266
Suggested Survival Kit Items .....	266
<b>CHAPTER 15: CROSS-COUNTRY SOARING .....</b>	<b>267</b>
<b>15.1 Glide Slope Management .....</b>	<b>267</b>
Safety Factor.....	267
Safe Glide Zone.....	267
The Glide Slope Ruler .....	268
Using a Glide Slope Ruler .....	269
Safe Glide Circles .....	270
Constructing a Glide Slope Ruler .....	272
<b>15.2 Cross-Country Supplies .....</b>	<b>274</b>
Personal Items.....	274
Navigation Items .....	275
<b>15.3 Speed-to-Fly Theory.....</b>	<b>276</b>
Speed Made Good .....	277
Maximizing Speed Made Good .....	277
Using a Speed Ring .....	278
Selecting a Speed Ring Setting .....	278
The Speed Ring and Maximizing Distance Covered .....	280
<b>15.4 Getting Started .....</b>	<b>281</b>
Prerequisites.....	281
Practicing Skills .....	282
<b>15.5 Choosing a Route.....</b>	<b>282</b>
<b>15.6 Flying the Route.....</b>	<b>283</b>
Determining Winds Aloft .....	283
Go/No-Go Decisions .....	285
Pilot Attitude.....	286
Landing.....	286
<b>15.7 Off-Field Landing.....</b>	<b>286</b>
Recognizing and Accepting the Situation .....	287
Determining Wind Speed and Direction .....	287
Selecting a Suitable Landing Field.....	288
Pattern and Landing .....	289
<b>15.8 Retrieve .....</b>	<b>291</b>
Ground Retrieve .....	291
Aero-Retrieve .....	292
<b>15.9 Crew Duties .....</b>	<b>293</b>
Pre-Flight .....	293

During Flight.....	294
Post-Flight.....	294
<b>CHAPTER 16: AERONAUTICAL DECISION MAKING .....</b>	<b>295</b>
<b>16.1 Situational Awareness .....</b>	<b>295</b>
What is Situational Awareness? .....	295
Areas Requiring Situational Awareness .....	296
Obstacles to Good Situational Awareness .....	296
Enhancing Situational Awareness .....	297
Situational Awareness Self-Assessment.....	298
<b>16.2 Judgment.....</b>	<b>299</b>
A Systematic Approach to Decision Making.....	299
Values .....	300
Obstacles to Good Judgment .....	300
Enhancing Good Judgment.....	302
<b>16.3 Self-Discipline.....</b>	<b>302</b>
Obstacles to Self-Discipline .....	302
Enhancing Self-Discipline .....	304
<b>GLOSSARY .....</b>	<b>305</b>
<b>INDEX.....</b>	<b>309</b>
<b>REVIEW QUESTIONS.....</b>	<b>313</b>
Chapter 1.....	313
Chapter 2.....	316
Chapter 3.....	323
Chapter 4.....	329
Chapter 5.....	334
Chapter 6.....	346
Chapter 7.....	359
Chapter 8.....	374
Chapter 9.....	377
Chapter 10.....	387
Chapter 11.....	390
Chapter 12.....	396
Chapter 13.....	402
Chapter 14.....	405
Chapter 15.....	407
Chapter 16.....	413
<b>ANSWER KEY .....</b>	<b>417</b>