

Contents

Preface	xiii
Why This Book Was Written	xiii
Training Curriculum	xiii
Training Aircraft	xiii
Airmanship	xiv
Why Talk About Airmanship?	xiv
 About the Editorial Team	 xv
 Introduction	 xvii
Why Learn Aerobatics?	xvii
Aerobic 'Wisdom'	xviii
 Chapter 1	
Terminology	1
General Terms	1
Departure (From Controlled Flight)	1
Load Factor	1
Rolling g	1
Wing-Root Bending Moment	1
Vectors	2
Components	2
Resultant	2
Centripetal Force (CF)	2
Centrifugal Reaction (CR)	2
Simple Aerobic Manoeuvres	3
Rolls	3
Aileron Roll	3
Barrel Roll	3
Slow Roll	4
Hesitation Roll	4
Flick Roll (Snap Roll – US)	4
Turns	5
Chandelle	5
Wing-Over	5
Wing-Under	6
Stall Turn (Hammerhead – US)	6

Inverted Turn (Outside Turn)	7
Derry Turn.	7
Loops	7
Normal Loop	7
Outside Loop	8
Square Loop.	8
Avalanche (Porteous Loop)	8
Complex Aerobatic Manoeuvres	9
Clover Leaf	9
Roll-Off-the-Top (or Immelmann Turn)	9
Half-Roll-and-Pull-Through (Split-S)	10
Vertical-S	10
Eights	11
Horizontal Eight	11
Vertical Eight	11
Cuban Eight	11
Reverse Cuban (Eight).	12
Knife-Edge Flight	12
Sideslip (also β , Beta)	13
Angle of Attack (also α , Alpha)	13
Spins.	13
Spin or Stable Spin.	13
Unstable Spin.	13
Flat Spin	13
Pro-Spin	14
Anti-Spin.	14
Inadvertent Inverted Spin.	14
Speeds	14

Chapter 2

The Physics of Manoeuvring Flight.	15
Isaac in Flight	15
The Perfect World – Zero Gravity	16
Turning – What Is a Turn?	20
So, What Is Causing the Turn?	20
Which Control Does What?	21
Attitude, Angle of Attack and Flightpath.	22
How Does an Aircraft Manoeuvre?	24
Zooms, Climbs and Dives	27
The Nature of Manoeuvring	27
The Laws	27
Maximum Performance Manoeuvring (Flight at the Limits)	27
Energy.	28

Excess (Spare) Lift	29
Excess (Spare) Thrust	30
Structural Limits	31
Rolling g	32
Spades	33
Gusts	34
Pilot Limits.	34
Flight Envelope	34
The V-n Diagram.	35
Load Factor Limits	36
Manoeuvring Efficiently Within the Limits	37
The Roller-Coaster and Centripetal Force	38
Inverted Dive	40
Low-Speed Flight	44
Stalling	44
Loss and Restoration of Controlled Flight	44
Departure from Controlled Flight	45
Avoiding Loss of Control	45
Regaining Control.	45
Autorotation	46
Spinning	47
Entering the Spin	48
Autorotation	48
Deliberate Entry	48
Unintentional Departures	49
Spin Recovery	49
Use of Power	51
Non-Standard Recovery	51
Control Position (Especially If the Aircraft Has a Yoke)	51
Direction of Spin.	51
Where to Look During a Spin	52
Spiral Dive	52
Situation One	52
Situation Two	54
Situation Three	54
Summary	54
Escape Routes	55
The Nearest Horizon.	55
Mishandled or Misjudged Manoeuvres	56
Nose-Low Recoveries	57
Nose-High Recoveries	57
Extreme Attitude and Vertical Recoveries	57
Vertical Recoveries	58
Tailslides.	59

Chapter 3

The Physiology of Manoeuvring Flight	61
How Does an Aircraft Manoeuvre?	61
Physiological Symptoms of Load Factor	63
Grey-Out, Black-Out and g-loc	63
A-loc	64
Recovery	65
Pilot Protection	65
Negative g	67
How the Body Senses Motion and Which Way Is Up	67
Hearing and Balance	67
The Structure of the Ear	68
Manoeuvre Rates	69
Disorientation	71
The Body's Ability to Cope with g and Manoeuvre Rates	72
Fitness and Recency	72
Rate of Application/Onset of g	73
Airsickness	73
Stress and Anxiety	73
Aerobatics in a Hot Climate	74

Chapter 4

Control Technique and Feel	75
Energy Management	76
What Does All This Mean?	76
Where To Look – Leading With Your Chin	76
Technique	77
The Use of Trim	78
The Use of Power	79
Power Control and Care of the Engine	79
Fixed-Pitch Propeller	79
Constant-Speed Propeller	79
Torque and Slipstream	79
Engine/Propeller Stoppage	80
Slipperiness	80

Chapter 5

Preparation for Aerobatics	81
Where to Learn	81
Choosing an Aerobatic Training Aircraft	81

Choosing an Instructor	82
Choosing a School	82
Aerobatic Area	82
Parachutes	82
Self-Evaluation/Preparation	83
Medical Fitness	83
Physical Fitness	83
Hardening	83
Sleep	83
Diet	83
Mental Preparation	83
Recency	84
Clothing	85
Flying Suit	85
Shoes	85
Gloves	85
Scarf/Headband	85
Headset Security	85
Hats and Sunscreen	85
Sunglasses	85
Pre-Flight Inspection	86
Loose Objects	86
Strapping-In	86
Preparatory Flying	86
Disorientation	86

Chapter 6

Aerobatic Manoeuvres	87
Maximum Performance Turning	87
Description	87
Piloting Technique	87
Points of Airmanship	87
The Wing-Over	88
Description	88
Piloting Technique	88
Points of Airmanship	93
The Wing-Under	94
The Chandelle	95
The Aileron Roll	96
Description	96
Piloting Technique	97
Points of Airmanship	99

The Loop	100
Description	100
Piloting Technique	100
Is a Loop Round?	104
Points of Airmanship.	106
The Cuban Eight.	107
The Reverse Cuban	107
The Barrel Roll	108
Description	108
Piloting Technique	111
Common Errors With the Barrel Roll.	114
Points of Airmanship.	115
The Stall Turn	116
Description	116
Piloting Technique	118
Points of Airmanship.	121
Inverted Flight.	122
Description	122
Piloting Technique	123
Rolling to Inverted Flight	124
Rolling to Erect Flight	125
Points of Airmanship.	126
The Slow Roll	127
Description	127
Piloting Technique	128
Points of Airmanship.	130
Roll-Off-the-Top (Immelmann Turn).	131
Description	131
Piloting Technique	132
Points of Airmanship.	132
Half-Roll-and-Pull-Through (Split-S)	133
Description	133
Piloting Technique	133
Points of Airmanship.	133
Vertical Eight.	134
Knife-Edge Flight	135
Description	135
Piloting Technique	136
Points of Airmanship.	136
Hesitation Rolls	137
Description	137
Piloting Technique	137
Points of Airmanship.	137
Flick Roll (Snap Roll).	138

Description	138
Piloting Technique	139
Points of Airmanship	139
Avalanche (Porteous Loop)	140
Description	140
Piloting Technique	141
Points of Airmanship	141
Derry Turn	142
Description	142
Piloting Technique	142
Points of Airmanship	142

Chapter 7

An Aerobatic Sequence	143
Designing the Sequence	143
What Do You Think?	144
Draw Mud-Maps and Do a Rain Dance	144
Aresti Notation	144
Performing the Sequence	146
Tips	146

Chapter 8

A Basic Aerobatic Training Programme	147
Teaching Aerobatics	147
General Description of the Programme	148
Detailed Sequence of Instruction	148
Flight Zero: Tailwheel Endorsement (if Appropriate)	149
Description	149
Points of Airmanship	149
Flight One: Aircraft Type Familiarisation or Refresher	149
Description	150
Points of Airmanship	150
Flight Two: The Aileron Roll and Loop	150
Description	150
Points of Airmanship	150
Flight Three: The Barrel Roll and Stall Turn	151
Description	151
Points of Airmanship	151
Flight Four: Half Rolls, Inverted Flight and the Complete Slow Roll	151
Description	151
Points of Airmanship	151

Flight Five: The Cuban Eight, Roll-off-the-Top and Avalanche	152
Description	152
Points of Airmanship.	152
Flight Six: A Basic Aerobatic Sequence	152
Description	152
Points of Airmanship.	152
 Afterword	 153
Advanced Manoeuvring	153
Manoeuvring Relative to the Ground: The Effects of Wind.	153
Back to Earth	153
 Index	 155

