

Table of Contents

Preface	v
Acknowledgments	vii
Chapter 1	
Introduction to the Helicopter	1-1
Introduction.....	1-1
Turbine Age.....	1-2
Uses.....	1-3
Rotor System.....	1-3
Rotor Configurations.....	1-4
Tandem Rotor	1-4
Coaxial Rotors	1-4
Intermeshing Rotors.....	1-4
Tail Rotor	1-5
Controlling Flight.....	1-5
Cyclic	1-5
Collective	1-5
Antitorque Pedals.....	1-6
Throttle	1-6
Flight Conditions	1-6
Chapter Summary	1-7
Chapter 2	
Aerodynamics of Flight	2-1
Introduction.....	2-1
Forces Acting on the Aircraft	2-2
Lift.....	2-3
Bernoulli's Principle.....	2-3
Venturi Flow.....	2-4
Newton's Third Law of Motion.....	2-5
Weight	2-5
Thrust	2-6
Drag.....	2-6
Profile Drag	2-6
Induced Drag	2-7
Parasite Drag.....	2-7
Total Drag.....	2-7
Airfoil	2-7
Airfoil Terminology and Definitions	2-7
Airfoil Types	2-8
Symmetrical Airfoil.....	2-8
Nonsymmetrical Airfoil (Cambered).....	2-8
Blade Twist	2-9
Rotor Blade and Hub Definitions	2-9
Airflow and Reactions in the Rotor Disk.....	2-9
Relative Wind.....	2-9
Rotational Relative Wind (Tip-Path Plane).....	2-9
Resultant Relative Wind.....	2-11
Induced Flow (Downwash)	2-11
Rotor Blade Angles	2-12
Angle of Incidence.....	2-12
Angle of Attack.....	2-13
Powered Flight.....	2-14
Hovering Flight.....	2-14
Translating Tendency (Drift).....	2-15
Pendular Action.....	2-15
Coning	2-16
Coriolis Effect (Law of Conservation of Angular Momentum)	2-16
Gyroscopic Precession	2-17
Vertical Flight.....	2-17
Forward Flight	2-17
Airflow in Forward Flight	2-19
Advancing Blade	2-19
Retreating Blade	2-19
Dissymmetry of Lift	2-20
Translational Lift.....	2-21
Effective Translational Lift (ETL).....	2-22
Translational Thrust.....	2-22
Induced Flow.....	2-23
Transverse Flow Effect	2-23
Sideward Flight.....	2-23
Rearward Flight	2-24
Turning Flight	2-24
Autorotation	2-25
Vertical Autorotation.....	2-25
Autorotation (Forward Flight).....	2-26
Chapter Summary	2-26
Chapter 3	
Helicopter Flight Controls	3-1
Introduction.....	3-1
Collective Pitch Control.....	3-2
Throttle Control	3-2
Governor/Correlator	3-2
Cyclic Pitch Control.....	3-3
Antitorque Pedals.....	3-4
Heading Control	3-4
Chapter Summary	3-5

Chapter 4	
Helicopter Components, Sections, and Systems	4-1
Introduction	4-1
Airframe	4-1
Fuselage	4-2
Main Rotor System	4-2
Semirigid Rotor System	4-2
Rigid Rotor System	4-3
Fully Articulated Rotor System	4-4
Tandem Rotor	4-6
Coaxial Rotors	4-6
Intermeshing Rotors	4-6
Swash Plate Assembly	4-6
Freewheeling Unit	4-7
Antitorque System	4-7
Fenestron	4-8
NOTAR®	4-8
Antitorque Drive Systems	4-8
Engines	4-8
Reciprocating Engines	4-8
Turbine Engines	4-8
Compressor	4-10
Combustion Chamber	4-10
Turbine	4-10
Accessory Gearbox	4-10
Transmission System	4-10
Main Rotor Transmission	4-11
Dual Tachometers	4-11
Structural Design	4-12
Clutch	4-12
Belt Drive Clutch	4-12
Centrifugal Clutch	4-13
Fuel Systems	4-13
Fuel Supply System	4-13
Engine Fuel Control System	4-14
Carburetor Ice	4-14
Fuel Injection	4-15
Electrical Systems	4-16
Hydraulics	4-16
Stability Augmentations Systems	4-17
Force Trim	4-17
Active Augmentation Systems	4-17
Autopilot	4-18
Environmental Systems	4-18
Anti-Icing Systems	4-19
Engine Anti-Ice	4-19
Airframe Anti-Ice	4-19
Deicing	4-19
Chapter Summary	4-19

Chapter 5	
Rotorcraft Flight Manual	5-1
Introduction	5-1
Preliminary Pages	5-2
General Information (Section 1)	5-2
Operating Limitations (Section 2)	5-2
Instrument Markings	5-2
Airspeed Limitations	5-2
Altitude Limitations	5-3
Rotor Limitations	5-3
Powerplant Limitations	5-3
Weight and Loading Distribution	5-4
Flight Limitations	5-4
Placards	5-4
Emergency Procedures (Section 3)	5-4
Normal Procedures (Section 4)	5-5
Performance (Section 5)	5-5
Weight and Balance (Section 6)	5-5
Aircraft and Systems Description (Section 7)	5-5
Handling, Servicing, and Maintenance (Section 8)	5-5
Supplements (Section 9)	5-6
Safety and Operational Tips (Section 10)	5-6
Chapter Summary	5-6

Chapter 6	
Weight and Balance	6-1
Introduction	6-1
Weight	6-2
Basic Empty Weight	6-2
Maximum Gross Weight	6-2
Weight Limitations	6-2
Balance	6-2
Center of Gravity	6-2
CG Forward of Forward Limit	6-3
CG Aft of Aft Limit	6-3
Lateral Balance	6-3
Weight and Balance Calculations	6-4
Reference Datum	6-4
Chapter Summary	6-4

Chapter 7	
Helicopter Performance	7-1
Introduction	7-1
Factors Affecting Performance	7-2
Moisture (Humidity)	7-2
Weight	7-2
Winds	7-2
Performance Charts	7-2
Height/Velocity Diagram	7-2
The Effect of Weight Versus Density Altitude	7-3
Autorotational Performance	7-4

Hovering Performance	7-4	Hovering Turn.....	9-7
Sample Hover Problem 1.....	7-5	Technique	9-7
Sample Hover Problem 2.....	7-5	Common Errors	9-9
Sample Hover Problem 3.....	7-6	Hovering—Forward Flight	9-9
Climb Performance.....	7-6	Technique	9-9
Sample Cruise or Level Flight Problem	7-8	Common Errors	9-9
Sample Climb Problem.....	7-8	Hovering—Sideward Flight.....	9-9
Chapter Summary	7-9	Technique	9-9
		Common Errors	9-10
Chapter 8		Hovering—Rearward Flight	9-10
Ground Procedures and Flight		Technique	9-10
Preparations.....	8-1	Common Errors	9-10
Introduction.....	8-1	Taxiing	9-10
Preflight.....	8-2	Hover Taxi.....	9-10
Minimum Equipment Lists (MELs) and		Air Taxi	9-10
Operations with Inoperative Equipment.....	8-2	Technique	9-11
Engine Start and Rotor Engagement.....	8-3	Common Errors	9-11
Rotor Safety Considerations.....	8-3	Surface Taxi	9-11
Aircraft Servicing.....	8-4	Technique	9-11
Safety in and Around Helicopters.....	8-4	Common Errors	9-11
Ramp Attendants and Aircraft Servicing		Normal Takeoff from a Hover	9-12
Personnel	8-4	Technique	9-12
Passengers	8-4	Common Errors	9-12
Pilot at the Flight Controls	8-6	Normal Takeoff from the Surface.....	9-13
After Landing and Securing	8-6	Technique	9-13
Chapter Summary	8-6	Common Errors	9-13
		Crosswind Considerations During Takeoffs.....	9-13
Chapter 9		Ground Reference Maneuvers	9-13
Basic Flight Maneuvers	9-1	Rectangular Course	9-14
Introduction.....	9-1	Technique	9-14
The Four Fundamentals	9-2	Common Errors	9-15
Guidelines	9-2	S-Turns	9-15
Straight-and-Level Flight.....	9-3	Technique	9-15
Technique	9-3	Common Errors	9-16
Common Errors	9-3	Turns Around a Point	9-16
Turns	9-3	Technique	9-16
Technique	9-3	Common Errors	9-17
Slips.....	9-4	Traffic Patterns.....	9-17
Skids.....	9-4	Approaches	9-18
Normal Climb	9-5	Normal Approach to a Hover	9-19
Technique	9-5	Technique	9-19
Common Errors	9-5	Common Errors	9-19
Normal Descent	9-5	Normal Approach to the Surface.....	9-20
Technique	9-5	Technique	9-20
Common Errors	9-6	Common Errors	9-20
Vertical Takeoff to a Hover	9-6	Crosswind During Approaches	9-20
Technique	9-6	Go-Around	9-20
Common Errors	9-6	Chapter Summary	9-20
Hovering	9-7		
Technique	9-7		
Common Errors	9-7		

Chapter 10

Advanced Flight Maneuvers.....10-1

Introduction.....	10-1
Reconnaissance Procedures.....	10-2
High Reconnaissance.....	10-2
Low Reconnaissance.....	10-2
Ground Reconnaissance.....	10-2
Maximum Performance Takeoff.....	10-2
Technique.....	10-3
Common Errors.....	10-3
Running/Rolling Takeoff.....	10-3
Technique.....	10-4
Common Errors.....	10-4
Rapid Deceleration or Quick Stop.....	10-4
Technique.....	10-4
Common Errors.....	10-5
Steep Approach.....	10-5
Technique.....	10-6
Common Errors.....	10-6
Shallow Approach and Running/Roll-On Landing.....	10-6
Technique.....	10-7
Common Errors.....	10-7
Slope Operations.....	10-7
Slope Landing.....	10-8
Technique.....	10-8
Common Errors.....	10-8
Slope Takeoff.....	10-8
Technique.....	10-9
Common Errors.....	10-9
Confined Area Operations.....	10-9
Approach.....	10-10
Takeoff.....	10-10
Common Errors.....	10-10
Pinnacle and Ridgeline Operations.....	10-11
Approach and Landing.....	10-11
Takeoff.....	10-11
Common Errors.....	10-12
Chapter Summary.....	10-12

Chapter 11

Helicopter Emergencies and Hazards.....11-1

Introduction.....	11-1
Autorotation.....	11-2
RPM Control.....	11-3
Risk Management during Autorotation Training.....	11-3
Straight-In Autorotation.....	11-4
Technique (How to Practice).....	11-4
Common Errors.....	11-5
Autorotation with Turns.....	11-6
Common Errors.....	11-7
Practice Autorotation with a Power Recovery.....	11-7

Technique (How to Practice).....	11-7
Common Errors.....	11-8
Practicing Power Failure in a Hover.....	11-8
Technique (How to Practice).....	11-8
Common Errors.....	11-9
Vortex Ring State.....	11-9
Common Errors—Traditional Recovery.....	11-10
Common Errors—Vuichard Recovery.....	11-10
Retreating Blade Stall.....	11-10
Common Errors.....	11-11
Ground Resonance.....	11-11
Dynamic Rollover.....	11-11
Critical Conditions.....	11-12
Cyclic Trim.....	11-12
Normal Takeoffs and Landings.....	11-13
Slope Takeoffs and Landings.....	11-13
Use of Collective.....	11-13
Precautions.....	11-13
Low-G Conditions and Mast Bumping.....	11-14
Low Rotor RPM and Rotor Stall.....	11-15
System Malfunctions.....	11-16
Antitorque System Failure.....	11-16
Landing—Stuck Left Pedal.....	11-17
Landing—Stuck Neutral or Right Pedal.....	11-17
Loss of Tail Rotor Effectiveness (LTE).....	11-18
Main Rotor Disk Interference (285–315°).....	11-20
Weathercock Stability (120–240°).....	11-20
Tail Rotor Vortex Ring State (210–330°).....	11-21
LTE at Altitude.....	11-21
Reducing the Onset of LTE.....	11-21
Recovery Technique (Uncontrolled Right Yaw).....	11-21
Main Drive Shaft or Clutch Failure.....	11-21
Hydraulic Failure.....	11-22
Governor or Fuel Control Failure.....	11-22
Abnormal Vibration.....	11-22
Low-Frequency Vibrations.....	11-22
Medium- and High-Frequency Vibrations.....	11-23
Tracking and Balance.....	11-23
Multiengine Emergency Operations.....	11-23
Single-Engine Failure.....	11-23
Dual-Engine Failure.....	11-23
Lost Procedures.....	11-23
VFR Flight into Instrument Meteorological Conditions.....	11-24
Emergency Equipment and Survival Gear.....	11-27
Chapter Summary.....	11-27

Chapter 12

Night Operations12-1

Introduction.....	12-1
Visual Deficiencies.....	12-2
Night Myopia.....	12-2
Hyperopia.....	12-2
Astigmatism.....	12-2
Presbyopia.....	12-2
Vision in Flight.....	12-2
Visual Acuity.....	12-3
The Eye.....	12-4
Cones.....	12-4
Rods.....	12-4
Night Vision.....	12-4
Night Scanning.....	12-4
Obstruction Detection.....	12-5
Aircraft Lighting.....	12-6
Visual Illusions.....	12-6
Relative-Motion Illusion.....	12-6
Confusion with Ground Lights.....	12-6
Reversible Perspective Illusion.....	12-6
Flicker Vertigo.....	12-7
Night Flight.....	12-7
Preflight.....	12-7
Cockpit Lights.....	12-8
Engine Starting and Rotor Engagement.....	12-8
Taxi Technique.....	12-8
Night Traffic Patterns.....	12-8
Takeoff.....	12-8
En Route Procedures.....	12-9
Collision Avoidance at Night.....	12-9
Approach and Landing.....	12-9
Illusions Leading to Landing Errors.....	12-9
Featureless Terrain Illusion.....	12-10
Atmospheric Illusions.....	12-10
Ground Lighting Illusions.....	12-10
Helicopter Night VFR Operations.....	12-10
Chapter Summary.....	12-10

Chapter 13

Effective Aeronautical Decision-Making13-1

Introduction.....	13-1
Aeronautical Decision-Making (ADM).....	13-2
Scenario.....	13-2
Trescott Tips.....	13-3
The Decision-Making Process.....	13-4
Defining the Problem.....	13-4
Choosing a Course of Action.....	13-4
Implementing the Decision and Evaluating the Outcome.....	13-4
Decision-Making Models.....	13-5

Pilot Self-Assessment.....	13-6
Curiosity: Healthy or Harmful?.....	13-6
The PAVE Checklist.....	13-6
Single-Pilot Resource Management.....	13-7
Risk Management.....	13-9
Four Risk Elements.....	13-9
Assessing Risk.....	13-10
Using the 3P Model to Form Good Safety Habits.....	13-11
Workload or Task Management.....	13-12
Situational Awareness.....	13-13
Obstacles to Maintaining Situational Awareness.....	13-13
Operational Pitfalls.....	13-15
Controlled Flight Into Terrain (CFIT) Awareness.....	13-15
Automation Management.....	13-18
Chapter Summary.....	13-18

GlossaryG-1

IndexI-1

