



Principles *of* Helicopter Flight Syllabus

Second Edition

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About this Syllabus

Course Objective:

The objective of this syllabus is for the student to gain the necessary aeronautical skill, knowledge and experience to meet the requirements of a Private Pilot certificate with a Rotorcraft Category rating and a Helicopter class rating.

Prerequisites:

The student must be able to read, speak and understand the English language, meet the physical standards for a third class medical certificate, and possess a valid student pilot certificate. Student must be 16 years old to solo, and 17 years old to gain certification.

Experience Requirements for a Private Pilot Certificate Include:

35 hours of flight time (40 hours for Part 61 programs)

35 hours of ground training (no minimum time is specified for Part 61 programs)

Private Pilot Certification Course:

The Private License is made up of 2 requirements: Aeronautical Skill and Aeronautical Knowledge. This syllabus is written to satisfy 14 CFR Part 141 requirements. With the addition of 5 hours of flight, this syllabus will be equally effective for 14 CFR Part 61 programs. The syllabus is in four stages, containing modules. Each stage must be completed in ____ days, not to exceed 90 days. Each module contains both a flight and ground lesson. This presents an integrated flight training process and will promote easier learning and a more efficient flight training program. Ideally, the ground lesson will be completed prior to the flight. Each flight lesson must include a pre- and post-flight briefing.

Testing Procedures:

Each module contains a reading assignment associated with the ground training program. The review questions following each chapter will test the student's understanding of the material covered throughout the ground lesson, and must be answered prior to moving on to the next module. A stage exam is included with each stage, testing the student on both the ground and flight training material covered throughout the stage. This exam must be passed with a minimum score of 80%, and reconciled to 100%, in order to proceed to the next stage.

It is essential that the objective of each module be accomplished before moving on to the next module.

Minimum Requirements:

The time necessary for the syllabus to qualify for 141 operations includes meeting 35 hours of both ground and flight instruction (40 hours flight training for Part 61 programs). This is a minimum time—the national average for completion of the Private certificate is 73 flight hours. Many factors play into the finishing flight time: frequency of flying, cooperative weather, helicopter and instructor scheduling, and lapses in the flight training process. It is recommended the student fly at least twice a week. This type of schedule produces the most efficient training, and cuts down on review time. If there is a lapse in between flights, it may be necessary to review maneuvers: In this case review flights should be scheduled to make sure flight skills are mastered before moving on. (This will allow the student to continue following the syllabus, which is necessary for a 141 program.) The student should feel comfortable performing each task in all previous modules before progressing to the next stage. If the

student exceeds more than ____ hours of the minimum 141 recommended time allotted per module, the chief flight instructor must be informed.

Instruction in a pilot ground trainer that meets the requirements of Part 141.41(a) may be credited for a maximum of 20% of the total flight training hour requirements. Instruction in a pilot ground trainer that meets the requirements for Part 141.41(b) may be credited for a maximum of 15% of the total flight training hour requirements. When a ground training device is used, the ideal sequence is to learn in the ground training device and practice in the helicopter.

Required Materials for the Private Pilot Rotorcraft Course:

- *Principles of Helicopter Flight* (#ASA-PHF-2)
- *Helicopter Flying Handbook* (#FAA-H-8083-21A)
- *Pilot's Handbook of Aeronautical Knowledge* (#FAA-H-8083-25)
- FAR/AIM (#ASA-FR-AM-BK, updated annually)
- Private Pilot Rotorcraft Practical Test Standards (#FAA-S-8081-15A)

Recommended Materials for the Private Pilot Rotorcraft Course:

- *ASA Private Pilot Test Prep* (#ASA-TP-P, updated annually)
- *ASA Helicopter Fundamentals* DVD (ASA-VTP-H)
- ASA logbook (student's choice)
- ASA flight computer (E6B or CX-2 Pathfinder)
- ASA plotter (student's choice)
- ASA flight logs for cross-country flights (#ASA-FP-2)
- *ASA Private Pilot Oral Exam Guide* (#ASA-OEG-P)
- *ASA Helicopter Oral Exam Guide* (#ASA-OEG-H)
- Sectional for local area
- Airport/Facility Directory for local area

The syllabus uses *Principles of Helicopter Flight* for the ground training program. The review following each chapter should be finished with the assigned reading. Certain ground lessons are supplemented with reading assignments from *Pilot's Handbook of Aeronautical Knowledge*. The *Rotorcraft Flying Handbook* is recommended to enhance the program. Each book contains an index that will help pinpoint the material for the subject you are working on. ASA's *Private Pilot Test Prep* is also recommended to enhance the program. Use of the Test Prep will ensure that the student is completely prepared for the FAA Knowledge Exam upon completion of the course. Instructors using this syllabus must ensure current Practical Test Standards are upheld and that *Helicopter Flying Handbook* (FAA-H-8083-21) procedures are maintained at all times.

If you have any questions on how to best use this syllabus, please call ASA directly at 1-800-ASA-2-FLY. We will be happy to provide suggestions on how to tailor this syllabus to specifically meet your training needs.

Note to Instructors:

Answers to the Stage Exams are available to instructors by calling 1-800-ASA-2-FLY, or fax your request on letterhead to 1-425-235-0128.

Private Pilot Minimum Course Hours

For Part 141, Appendix B Compliance

These course hours are for student/instructor guidance only. They are a suggested time schedule which will ensure minimum flight and ground training compliance with 14 CFR Part 141.

Note: Ground instruction should include classroom discussion, and pre- and post-flight briefings.

Page		Dual Flight	Solo Flight	Dual Cross-Country	Solo Cross-Country	Dual Night	Ground Instruction
01	Stage 1						
03	Module 1	1.0					1.5
04	Module 2	1.0					1.0
05	Module 3	1.0					1.5
06	Module 4	1.0					1.5
07	Module 5	1.0					1.5
08	Module 6	1.0					1.5
09	Module 7	1.0					1.5
10	Module 8	1.0					1.5
11	Module 9	1.0					1.5
12	Module 10	1.0					1.0
13	Module 11	1.0					1.5
14	Module 12	1.0					1.5
15	Module 13	0.5	0.5				0.5
16	Module 14/ Stage Check	1.0					1.0
19	Stage 2						
20	Module 1		1.0				
21	Module 2	0.5					1.0
22	Module 3		1.0				
23	Module 4	1.0					2.0
24	Module 5		1.0				
25	Module 6	1.0					1.0
26	Module 7		1.0				
27	Module 8/ Stage Check	1.0					1.0
28	Stage 3						
29	Module 1	1.0				1.0	1.5
30	Module 2	1.5		1.5			2.0
31	Module 3	1.0					2.0
32	Module 4	1.5		1.5		1.5	1.0
34	Module 5		1.5		1.5		
35	Module 6		2.0		2.0		0.5
36	Module 7/ Stage Check	1.0					1.0
37	Stage 4						
38	Module 1	1.0				1.0	1.0
39	Module 2	1.0					0.5
40	Module 3	1.0					1.0
41	Module 4/ Stage Check	1.0					
	TOTALS	23 + 4 Stage Checks	8.0	3.0	3.5	3.5	35

SFAR 73 – Instruction in Robinson Helicopters

SFAR 73 requires that specific training requirements be met for pilots of R22 and R44 helicopters.

1. Awareness training must be given by an endorsed instructor prior to manipulating the controls. The instruction must consist of:
 - Energy management
 - Mast bumping
 - Low rotor RPM (blade stall)
 - Low G hazards
 - Rotor RPM decay
2. Pilots with less than 200 hours (50 in the R22 or R44) must meet certain requirements before acting as Pilot in Command. See SFAR 73 and the endorsement provided on page 17. (Endorsement valid for 12 months.)

Training must include:

- 10 dual in same model Robinson
 - Enhanced training in autorotation procedures
 - Engine rotor RPM control without the use of the governor
 - Low rotor RPM recognition and recovery
 - Effects of low G maneuvers and proper recovery procedures
3. Specific requirements must be met within 90 days prior to solo flight (for non helicopter rated pilots). See SFAR 73 and the pre-solo endorsement for Robinson pilots on page 17.

Training must include:

- 20 hours dual in same model Robinson
- Enhanced training in autorotation procedures
- Engine rotor RPM control without the use of the governor
- Low rotor RPM recognition and recovery
- Effects of low G maneuvers and proper recovery procedures

Instructor's note: Use the following endorsement when signing off students for awareness training:

I certify that _____ (*First name, MI, Last name*) has received the Awareness Training required by SFAR 73 2(a)(3) in a _____ (*model of Robinson*)

[date] J. Jones 654321 CFI [expiration date]

Stage 1

Introduction to Helicopter Flying

Objective

The objective of Stage 1 is for the student to become proficient in, and have an understanding of the following:



Ground Training

- Course objective
- School requirements, procedures and regulations
- Grading criteria
- Forces acting on a helicopter
- Stability and control
- Training helicopter (airframe, engine, systems, flight instruments)
- Basic flight maneuvers
- Flight information
- Basic weather theory
- Emergency and hazardous conditions
- Flight physiology
- Regulations



Flight Training

- Flight training process
- Training helicopter
- Preflight
- “Special Emphasis Areas” (per PTS)
- Taxiing
- Four basics of flight (straight and level, turns, climbs, descents)
- Hovering
- Autorotations
- Use of sectional
- Airspace
- Collision avoidance
- Emergencies
- Steep Turns

Completion Standards

Stage 1 is complete when the student is ready and endorsed for solo flight. Student shall score at least 80% on the Stage 1 Exam, and all deficient areas shall be reconciled to 100%. Student shall have third-class medical and student pilot certificate upon completion of this stage.

Stage 1 / Module 1

Minimum 141 Requirements: Dual
1.0 hour flight
1.5 hours ground instruction



Ground Training

Objective:

For the student to be introduced to the Private Pilot Certification program, and learn the flight school requirements, procedures, regulations, and grading criteria. Student shall also become familiar with the atmosphere and the forces acting on a helicopter.

Content:

- ____ Review of course and objectives
- ____ School requirements, procedures, regulations
- ____ Grading criteria, expectations of student
- ____ Review objective of Stage 1
- ____ Atmosphere
 - ____ Atmospheric pressure
 - ____ Air temperature
 - ____ Combined effects
 - ____ Moisture content
 - ____ Standard atmosphere
 - ____ Pressure altitude
 - ____ Density altitude

The forces acting on a helicopter

- ____ Lift
 - ____ Definitions
 - ____ Lift formula
 - ____ Dynamic energy
 - ____ Center of pressure
 - ____ Aerodynamic center
- ____ Drag
 - ____ Drag formula
 - ____ Parasite drag
 - ____ Profile drag
 - ____ Form drag
 - ____ Skin friction
 - ____ Induced drag/methods to reduce
 - ____ Tip vortices
 - ____ Total drag curve
- ____ Lift/Drag ratio
 - ____ Best L/D ratio
 - ____ Factors influencing L/D ratio

Completion Standards:

This lesson is complete when the student has successfully completed all review questions following the assigned reading.

Assignment:

Principles of Helicopter Flight, 2nd Edition, Chapters 2–5



Flight Training

Objective:

For the student to be introduced to and become familiar with preflight inspections, checklist operations, starting and taxi procedures and the function and use of the helicopter controls.

Content:

- ____ Preflight inspection and aircraft documents (certificates and documents, aircraft logbooks, helicopter servicing, aircraft manual)
- ____ Introduction to PTS and special emphasis areas
- ____ SFAR 73 training if applicable (see page 17)
- ____ Positive exchange of flight controls
- ____ Familiarization with helicopter
- ____ Starting the engine and rotor engagement
- ____ Checklists/system checks
- ____ Normal takeoff
- ____ Hovering
- ____ Hover taxi
- ____ Normal departure and climb
- ____ Effects of controls
- ____ Attitude and power changes—power, attitude and speed change
- ____ Normal approach to landing
- ____ Postflight procedures

Completion Standards:

This module is complete when the student can conduct the preflight with minimum assistance, properly use all checklists, start the helicopter, and operate the controls.

Recommended Reading:

FAA-8083-21A, Chapters 3–5

Stage 1 / **Module 1**

Date of Completion: _____

Signature: _____

Time Flown: _____

Stage 1 / **Module 2**

Minimum 141 Requirements: Dual
1.0 hour flight
1.0 hour ground instruction



Ground Training

Objective:

To introduce the student to the aerodynamic principles of climbing, descending and turning a helicopter. Students will also get a review of basic physics in the reading.

Content:

- ___ Controls and their effects
- ___ Hover
 - ___ In and out of ground effect
 - ___ Factors in ground effect
 - ___ Over-controlling
- ___ Forward flight
 - ___ Basic aspects of horizontal flight
 - ___ Changing disc attitude
 - ___ Dissymmetry of lift
 - ___ Elimination of dissymmetry of lift
 - ___ Flapback
- ___ Designs that reduce flapping amplitude
- ___ Reverse flow
- ___ Translational lift
- ___ Transverse flow effect
- ___ Climbing
 - ___ Horsepower-available curve
 - ___ Rate of climb
 - ___ Angle of climb
 - ___ Effect of wind
- ___ Descending
 - ___ Angle of descent
 - ___ Effect of wind

Completion Standards:

This lesson is complete when the student has successfully completed all review questions following the assigned reading.

Assignment:

Principles of Helicopter Flight, 2nd Edition, Chapters 1, 10, 11, 12, and 14



Flight Training

Objective:

To gain experience with hovering and improve basic operation of the controls. The student will also be introduced to collision avoidance procedure and be made aware of mast bumping conditions.

Content:

- ___ Preflight
- ___ Personal checklist—"IM SAFE"
- ___ Surface markings
- ___ Mast bumping
- ___ Takeoff and landing
- ___ Hovering
- ___ Hover Taxi
- ___ Shallow and medium banked turns
- ___ Scanning procedures
- ___ Normal approach and landing
- ___ Postflight procedures

Completion Standards:

This module is complete when the student has basic control of the aircraft in a hover and can maintain altitude within 300 feet, airspeed within 20 knots and heading within 20 degrees while performing the maneuvers of this module.

Recommended Reading:

FAA-H-8083-21A, Chapter 9 (1-10)

Stage 1 / **Module 2**

Date of Completion: _____

Signature: _____

Time Flown: _____

Stage 1 / Module 3

Minimum 141 Requirements: Dual
1.0 hour flight
1.5 hours ground instruction



Ground Training

Objective:

For the student to gain an understanding of how helicopter systems function.

Content:

- ___ Engines
- ___ Fuel systems
- ___ Electrical systems
- ___ Hydraulics
- ___ Environmental systems
- ___ Anti-icing systems
- ___ Transmission
- ___ Main rotor gear box
- ___ Freewheeling unit
- ___ Drive shafts
- ___ Tail rotor gear box
- ___ Rotor brake
- ___ Clutch
- ___ Chip detectors
- ___ Swashplate
- ___ Rotor blades
- ___ Trim controls
- ___ Tail rotors
- ___ Vibrations
- ___ Control functions
- ___ Engine cooling
- ___ Dual tachometer instruments
- ___ Rotor stabilizing design systems

Completion Standards:

This lesson is complete when the student has successfully completed all review questions following the assigned reading.

Assignment:

FAA-H-8083-21, Chapter 5

Principles of Helicopter Flight, 2nd Edition, Chapter 20



Flight Training

Objective:

For the student to become familiar with the local area and to practice the four basics of flight: straight and level, climbs, turns, and descents.

Content:

- ___ Use of sectional
- ___ Preflight
- ___ Land and hold short operations
- ___ Normal takeoff and departure
- ___ Hover taxi
- ___ Hovering
- ___ Four basics of flight: Level flight, climbing, descending and turning
- ___ Sideways and backward flight
- ___ Transitions—leaving the hover to achieve forward flight and returning to the hover from forward flight
- ___ Normal approach and landing
- ___ Traffic patterns
- ___ Postflight procedures

Completion Standards:

This module is complete when the student can maintain flight within 250 feet altitude, 20 degrees heading and 20 knots airspeed while performing the maneuvers listed in the content of this module. Also the student must be proficient in postflight operations and be oriented to the practice area and airport.

Recommended Reading:

FAA-H-8083-21A, Chapter 9 (11-20)

Stage 1 / **Module 3**

Date of Completion: _____

Signature: _____

Time Flown: _____

Principles of Helicopter Flight Syllabus

Second Edition

Principles of Helicopter Flight, by Walter J. Wagtendonk, explains the complexities of helicopter flight in clear, easy-to-understand terms. The worldwide helicopter industry has waited a long time to see a manual of this caliber.

Helicopter pilots need to thoroughly understand the consequences of their actions, and base them upon sound technical knowledge. This textbook provides the background knowledge explaining why the helicopter flies and, more importantly, why it sometimes doesn't. It examines the aerodynamic factors associated with rotor stalls, mast bumping, wind effect, as well as the maneuvering flight to include the hover, forward flight, the flare, autorotation. Helicopter design and components, performance, and weight and balance is covered, along with special techniques such as different types of takeoffs and landings, operating on sloping surfaces, sling operations, mountain flying, and helicopter icing. Technical knowledge and sound handling are the ingredients that make a pilot safe.

For the student learning to fly helicopters in the 21st century, this book is one of the essential keys to flight.



"Wal" Wagtendonk served in the Royal New Zealand Air Force, retiring as an A-2 instructor in 1960. After working with the Nelson Aero Flight Club as Manager and Chief Flight Instructor, Wal, with his wife Ann, formed the Nelson Aviation College in Motueka, which blossomed into one of New Zealand's best known theory and flight training establishments. Nelson Aviation College became the first "approved" school to conduct both fixed-wing and helicopter courses, and

many experienced helicopter pilots currently flying all over the world started their basic training under Wal's careful instruction.

Wal was born in The Netherlands, and emigrated to New Zealand at age 20. Having retired in 1990, Wal and Ann now reside in the Bay of Plenty on New Zealand's North Island.



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