DEPARTMENT OF THE ARMY
UNITED STATES ARMY PRIMARY HELICOPTER SCHOOL
FORT WOLTERS, TEXAS 76067

ATSPH-EAD-S 15 January 1970

SUBJECT: Change No 3 to Helicopter Primary Flight Training Manual, dated 15 January 1970

TO: Holder, Helicopter Primary Flight Training Manual

Remove and insert the following pages to the Helicopter Primary Flight Training Manual. Change consists of revised pages for previous pen and ink changes plus new changes. Record your action on the Record of Changes page and enter this page in the front of the manual.

REMOVE	INSERT
Foreword	Foreword
Record of Changes	Record of Changes
Table of Contents	Table of Contents
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Pages X-1 thru 4	Pages X-1 thru 4
Pages X-7 thru 11	Page X-7
Destroy OH-23D Preflight Pamphlet dtd 18 Jun 69	Use OH-23D Preflight Pamphlet dtd 15 Jan 70
Destroy TH-55 Preflight Pamphlet dtd 18 Jun 69	Use TH-55 Preflight Pamphlet dtd 15 Jan 70

FOR THE COMMANDANT:

GAITHER C. BRAY
LTC, TC
Secretary

RECORD OF CHANGES

Changes will be published when necessary to add, delete, revise or up-date this manual. Changes will be issued on a page substitution basis only. A page bearing a change will contain the effective date on the lower left hand corner with the point of change underlined.

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Basic		
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HEADQUARTERS

UNITED STATES ARMY PRIMARY HELICOPTER SCHOOL

FORT WOLTERS, TEXAS

15 JANUARY 1970

HELICOPTER PRIMARY FLIGHT TRAINING MANUAL

FOREWORD

The techniques, procedures, and maneuvers described in this manual will help you become proficient in the fundamentals of helicopter flying.

To provide continuity of instruction and to give you the necessary background for beginning each successive stage of your flight training, all subjects covered here are in the logical sequence in which they will be presented to you by your instructor.

Theory in this manual will be supplemented by your academic training. The repetition of theory here and in your academic studies is considered necessary to insure a positive transfer of the theory to practical application. Your instructors and supervisors will be held responsible for presenting all primary flying training in accordance with the contents of this manual.

Although this material is designed primarily to give you a sound foundation for primary pilot training, you will use these same techniques throughout your Army career.

FOR THE COMMANDANT:

GAITHER C. BRAY
LTC, TC
Secretary

SECTION I

INTRODUCTION TO PRIMARY FLIGHT TRAINING

This manual is directive in nature for students and instructors in organizing and standardizing the course of rotary-wing instruction.
Primary training provides the opportunity to learn precision and maximum performance flying. Military pilots, like all professional pilots, must develop the highest degree of proficiency possible.
Flying requires initiative, good judgment, and trained reflexes as well as skillful flying technique. Becoming an Army Aviator should be incentive enough for you to make every effort to complete your training successfully. Hard work and determination offer you this reward.
Everyone at this training facility, from the Commanding General to the men who wash the aircraft, will do everything in their power to help you. If the program sometimes seems impersonal or rigid, remember that everyone is carrying a heavy load of responsibilities.

Primary Helicopter Pilot Training:

Helicopter training involves close coordination between classroom and flight line training. The better you master the classroom theory, the easier it will be for you to perform the operational maneuvers in the aircraft. Each part of pilot training, classroom and flight line, will clarify and enliven the other.
The objective of the flight training presented at this facility is to develop you into a skilled aviator. Your muscular responses will be developed to the point where they become reflex actions. As you gain flying proficiency, the acuteness of your senses - hearing, seeing and feeling - will develop along with your muscular responses.

Your Instructor:

Your instructor is a well-qualified pilot. His objective is to graduate expert pilots, and he will expect you to do your best. If he places great importance on exactness, it is because he is trying to train you as close to perfection as possible. Many things may occur that will seem strange to you and contrary to your former ideas about flying. Make certain that you seek a solution to each problem. Do not be afraid to ask questions. You can never learn too much about flying. Pilots with years of experience and thousands of hours of flying are still asking questions and still learning.
Your instructor will brief you before each flight. In this preflight briefing, he will tell you what you will do, and how you will do it. Question any point that is not clear. After each daily flight, your instructor will review the day's lesson. This is your chance to clear up any mistaken ideas and to learn the correct procedure. Be sure to ask questions if you have failed to grasp all the steps in any maneuver.

Pilot's Handbook of Flight Operating Instructions:

Technical Manuals known as TM's are published for most equipment in use by Army Aviation. It is the "bible" for your aircraft's operation. You should become familiar with this publication.

Local Flying Regulations:

The Helicopter Primary Flight Training Manual is designed to assist you in learning the basic elements in flying an aircraft. It cannot include certain types of detailed information which will vary because of local conditions. This type of information is published by USAPHS as memorandums and circulars.
USAPHS memorandums and circulars set forth rules to be followed while flying at this training facility. They cover such subjects as flying areas, traffic rules, and traffic patterns. They are written to insure safe, efficient operation.

Cockpit Time:

While you are waiting your turn to fly, you may find yourself without a specific assignment. You can use this time to become better acquainted with the cockpit of the aircraft, its controls, instruments and nomenclature. This period spent in the cockpit of an aircraft on the ground is commonly known as "cockpit time." Your instructor will outline the procedures and policies for utilizing this training. CAUTION: Do not manipulate control switches while becoming familiar with the cockpit. During your study of the cockpit, examine the checklist, and study the prescribed procedures. As you go through the checklist, visualize the movement of the controls and the readings of the instruments. This practice will develop the systematic approach you will need to perform the procedures in the checklist. Keep in mind that a thorough system is important in performing all procedures. The sooner you become familiar with the checklist, the cockpit arrangement, and the aircraft in general, the sooner your attention may be devoted to flying the aircraft.

Physical and Mental Condition:

Absorbing flying lessons quickly and completely requires physical stamina. Even if you are in top physical condition, learning all the information you will receive in the first few days will be fatiguing. Your first flights will not be long. Adjust your mental attitude so your mind is free to consider the techniques of flying. Good physical conditioning helps improve your mental condition. Flying requires the abilities of an above average, healthy man. Your mental and physical condition is important to a successful flight. In the same way that you conduct a preflight inspection of the aircraft, you should examine yourself to determine if there is anything that may reduce your normal physical or mental performance. Anything that could cause you to have a lowered performance you must bring to the attention of your superiors prior to flight. If required you will be referred for treatment or help. Do not try to treat yourself for any illness without first consulting a flight surgeon. Many common remedies can cause bad side effects and seriously limit your physical and mental abilities. Staying in the best possible physical and mental condition and reporting yourself to your superiors when you are not in the best of health is an important part of your duty as an Army aviator.

Flying Safety:

Take the proper steps to insure safety in flight. This is a rule you should learn early in your flying training. Plan the flight and make all necessary checks. A careless pilot may let himself, his crew, and his fellow pilots down because he failed to make a thorough preflight check. Remember, any item on a preflight check, if neglected, can easily become the most important factor in your life. Do not take your responsibility lightly. For your sake, as well as for that of others, get into the habit of making thorough preflight checks.
Throughout your entire flying career, you will be concerned with safety. Observe this rule always: LOOK AROUND: it means flying with safety:

Look above you.
Over your left shoulder.
Over your right shoulder.
Keep alert.
Always look before turning.
Rigid necks are dangerous.
Once is not enough.
Under you is a blind spot.
Never assume that others see you.
Divide your attention.

A most important flying safety requirement during your flying training is a clear and positive understanding at all times as to who has control of the aircraft. Stay on the controls and keep flying the aircraft until you are told to do otherwise. Never be in doubt as to who is doing the flying. Always fly as if you were flying solo unless you know that the instructor has the controls. Use the intercom to acknowledge change of controls.

Outside Study:

Learning to fly is learning to develop the proper reaction to an experience in an aircraft. You cannot understand each step unless you are prepared for it. Study each lesson and visualize how the pressures on the controls will change the attitude of the aircraft. Review the lessons of each day, visualizing the "why" behind each operation.

Graded Check Rides:

Purpose: The Military Flight Evaluation Branch of the USAPHS is responsible for evaluating effectiveness of the flight training administered to students and to maintain standardization of instructor pilot techniques by measuring the achievement levels of the students at selected intervals.

Local Flying Area:

Everyone should be thoroughly familiar with the local area and those areas in which certain maneuvers are to be performed.
There is a map of the local area in each flight room and in each stage house. Study it and become familiar with all prominent landmarks. You should be able to identify your position at any time.

Radio Discipline:

Radio voice communications will be kept to a minimum at all times. Decide exactly what should be said on the radio before depressing the mike button. Say it, then get off the air. Remember that when the mike button of the radio is depressed, the entire channel is blocked for other aircraft. Before depressing the mike button, check to see that the radio is on, and proper channel is selected. Be concise and brief. Monitor the air before transmitting.
Comply with all instructions from Control Towers or supervisory personnel. Do not transmit any comments as to the instructions received. Give them to your instructor after the flight.

Preflight Inspections and Checklists:

Performing a thorough and complete preflight and an accurate and complete cockpit check is one of the most important parts of your Primary Helicopter Training. The preflight and cockpit procedure checklist is designed to check all necessary items in a logical sequence. You will be taught the proper methods by your instructor. You will be expected to become proficient in both preflight and cockpit procedures.

Use of Checklist:

Use of the checklist by visual reference is required by Army regulations. Remember - the checklist sets up procedures, but will never take the place of good judgment and headwork.

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Special Instructions:

During your training at this school, you may be assigned to fly the OH-23 or the TH-55 helicopter. The airspeeds, altitudes and power settings used by these trainers have been standardized as much as is practicable. There are instances where some settings are different, such as RPM. The tables in Section II will establish the proper settings and procedures, by aircraft type, for those items that are commonly used.

BUDDY-RIDING

DEFINITION: Buddy-riding is a procedure whereby a student pilot will accomplish a solo lesson from the flight syllabus, and a second student pilot will be assigned to ride as an observer only for the purpose of gaining additional flight experience observing a student pilot fly.

PROCEDURES:

1. Primary I: There will be no buddy-riding in the Primary I phase.

2. Primary II.

a. Buddy-riding will be conducted only during navigation training. Buddy-riders will be assigned for day solo cross-country flights as often as scheduling permits. Buddy-riders will be assigned for all night solo cross-country flights.

b. The student assigned as pilot will fly the aircraft and will perform all navigation. Buddy-riders will not fly the aircraft, follow through on the controls, or make any comments on the conduct of the flight except to warn the student flying the aircraft of hazards to flight safety. The buddy-rider will assume control of the aircraft only if the student assigned to fly the aircraft becomes physically incapacitated. The buddy-rider may render assistance by holding maps, navigational equipment, and flashlight. He may assist in navigation if the student flying becomes disoriented.

c. The student pilot flying the aircraft will log flight time on DA Form 2408-12 in the same manner as a regular solo flight. The buddy-rider will enter his name below the name of the student flying the aircraft and enter "Z" in the "Duty" block.

TRANSFER OF AIRCRAFT CONTROLS

When transferring the controls from instructor to student, the exact voice procedure is: IP, "You have the Aircraft." Student, "I have it."
When transferring the controls from the student to the instructor, the exact voice procedure is: IP, "I have the Aircraft." Student, "You have it."

SECTION II

FUNDAMENTALS OF FLIGHT

Flying techniques are based upon one or more fundamental maneuvers of flight. In learning to fly, as in any process, you must master fundamentals before you can undertake the more advanced problems. Your ability to master these fundamentals in the primary flying curriculum will speed up your progress in mastering the more advanced maneuvers.

Effect and Use of Controls:

A proficient helicopter pilot must be thoroughly familiar not only with the cockpit in general, but with the function and proper application of each of the four separate controls.
Your flight instructor will carefully explain each control function and demonstrate its proper application. Don't be afraid to ask questions if you fail to understand any explanation or demonstration as it is impossible to fly the helicopter in a satisfactory manner without this knowledge.
This chapter is devoted to a basic explanation of the four separate controls that make up the helicopter control system. The system consists of the cyclic control, the collective pitch control, the engine throttle, and the anti-torque pedals. Each control can be operated directly by the pilot independently of the other three, but it is necessary, in most cases, to smoothly coordinate two or more controls of the system at the same time to obtain the desired result.

The Cyclic Control:

The cyclic is located directly in front of the pilot and is similar to the control stick in a conventional aircraft. The cyclic controls the attitude, direction of movement, and airspeed, The attitude of the aircraft is the relationship of the nose and sides of the aircraft to the horizon. The helicopter will always change its attitude and move in the direction of rotor disc tilt; this movement also corresponds to the cyclic control stick movement made by the pilot in the cockpit. Forward pressure on the cyclic causes the nose of the aircraft to go down and the airspeed will increase. The lower the nose, the faster the airspeed will be. If the airspeed is

stabilized at a given speed, the aircraft is in a corresponding attitude. By observing the relation of the top of the console and other objects in the cockpit to the horizon, the attitude can become fixed in your mind, and a desired airspeed may be maintained by primarily referring to the attitude of the aircraft.
The lift force of the main rotor can be resolved into two components; a vertical force and a horizontal force. The vertical force supports the helicopter; the horizontal force moves it through the air. Cyclic control, therefore, allows you to control horizontal movement of the helicopter, since, by application of cyclic control, you can change the direction of tilt of the main rotor to produce a resultant force in the desired direction.

Cyclic Trim

The cyclic trim button located on either pilot's or instructor pilot's cyclic stick is to relieve control pressures. The system is protected by a circuit breaker. To operate, move the trim button in the direction cyclic is displaced and release when cyclic is correctly positioned. The operation of the system will be demonstrated by your instructor.

The Collective Pitch Control:

The collective is located on the pilot's left at approximately the same level as the seat and is operated with the left hand. It is used to vary the lift of the main rotor by increasing or decreasing the pitch of the blades at the same time. The greater the pitch in the rotor blades, the more power you need to maintain proper engine RPM. Since in powered flight you always maintain a constant engine RPM, an increase or decrease in power is effectively controlled by the collective pitch.
Throttle linkage (synchronization) is designed to increase power automatically when the collective pitch is raised and to decrease power when pitch is lowered. This feature helps to maintain the engine at a constant RPM during normal flight maneuvers, while permitting you to change power as desired. Of course, if your RPM falls below or rises above the proper RPM even slightly, you will want to apply or reduce the necessary amount of throttle.

when the aircraft is turning. The length of time you remain in any particular part of a turn, in order to make a certain ground track, is governed by the direction and velocity of the wind. At times the wind will be blowing opposite to the way you are turning, and at other times in the same direction. The effect of wind drift, plus or minus the turn and the movement of the aircraft, will cause the ground track to vary. Therefore, in order to make good a desired ground track in a turn, you may have to increase or decrease the rate of turn. As you already know, the radius of turn is governed by the angle of bank and the airspeed of the aircraft. You can change the rate of turn by changing the angle of bank. The greater the bank, the faster the rate of turn. The shallower the bank, the slower the rate of turn.

Let us analyze the ground tracks that are created by performing turns first without, and then with, a wind condition existing. The first time this maneuver is demonstrated, you will be better able to visualize the ground track and the turns if there is no wind blowing. Later, however, you will benefit more from the maneuver if it is performed when a fairly strong wind is blowing and thus causing a more noticeable drifting effect.

Let us assume there is a no-wind condition existing. It would be simple in this case to make arcs of 180 degrees over the ground, because the air track and ground track are identical. All you have to do is approach a road from a 90-degree angle, and when you are directly over the road, roll into a turn with any angle of bank and maintain this same angle of bank for 180 degrees of turn. If the bank is steep, the turn will be fast. If the bank is shallow, the turn will be slow. This means that if you were to start your turn directly over the road, and turned 180 degrees while maintaining the same angle of bank, you should be back over the road just as you complete the turn. Remember, a constant angle of bank at a constant airspeed means a constant rate of turn.

You could then lead the roll-out to be level just as the aircraft reaches the road and roll immediately into a turn in the opposite direction, with the identical amount of bank. This would cause the aircraft to turn 180 degrees in the opposite direction, make exactly the same size semi-circle and be back to the road just as the turn is complete. This would be an ideal situation and would only be possible if there were no wind blowing, and if the angle of bank and the rate of turn remain constant throughout the entire maneuver.

Very rarely, however, does a no-wind condition exist. If you attempt to maintain a constant degree of bank, with the wind blowing perpendicular to the road, you would make a true semi-circle track through the air; but, with the air mass moving constantly, this would cause your ground track to differ from a true circle. Of course, the greater the wind velocity, the greater would be this difference.

To counteract for this wind drift effect, you can vary your air track in such a manner as to neutralize the drift effect of the wind, and cause the projected ground track to be a true semi-circle. This is accomplished by varying the angle of bank, consequently varying the rate of turn, to compensate for the drift effects caused by the various wind angles encountered in a turn.

These wind-drift effects, and the proper techniques just discussed, will apply in principle to all ground track maneuvers. These maneuvers will then help develop your ability to correct for wind drift in straight-and-level flight, and also in turns.

Later on in your training, your instructor will demonstrate and you will practice "S-Turns" and "Rectangular Course." A review of the preceding paragraphs, relative to "wind," will give you a better knowledge of how to perform these maneuvers.

OPERATING INSTRUCTIONS

OH-23D and G

AIRSPEEDS

Cruise	50 Kts
Climb & Descent	40 Kts
High Cruise	60 Kts
Autorotations	45-50 Kts

ENGINE RPM SETTINGS

Hover, Take-Off and Climb	3200 RPM
Cruise and Descent Above 500 Feet	3100 RPM
Ground Reconnaissance	2200 RPM
Autorotations (Entry)	3200 RPM
Simulated Forced Landings and Autorotations	2500-2700 RPM
Descents Below 500 Feet	3200 RPM
Rotor RPM Operating Range (Green Area)	315-370 RPM

POWER SETTINGS
(Manifold Pressure)

(CAUTION: Do not exceed 25.2 inches - OH-23G)

Hover	Power necessary to hover at an altitude of 3 feet into the direction of take-off, using 3200 RPM.
Normal Take-Off and Climb	Hover power.
Descent and Approach	Power as necessary.
Cruise	Power necessary to maintain 50 Kts, or 60 Kts during high cruise.
Maximum Performance Take-Off	2 inches above hover power or full throttle, whichever occurs first.

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AIRSPEEDS

Cruise	50 Kts
Climb & Descent	40 Kts
High Cruise	60 Kts
Autorotations	45-50 Kts

ENGINE RPM SETTINGS

Hover, Take-Off and Climb	2900 RPM
Cruise and Descent Above 500 Feet	2700 RPM
Ground Reconnaissance	1850 RPM
Autorotations (Entry)	2900 RPM
Simulated Forced Landings and Autorotations	2500-2700 RPM
Descents Below 500 Feet	2900 RPM
Rotor RPM Operating Range (Green Area)	400-530 RPM

POWER SETTINGS
(Manifold Pressure)

Hover	Power as necessary to hover at an altitude of 3 feet into the direction of take-off using 2900 RPM.
Normal Take-Off and Climb	Hover power.
Descent and Approach	Power as necessary.
Cruise	Power as necessary to maintain 50 Kts or 60 Kts for high cruise.
Maximum Performance Take-Off	2 inches above hover power or full throttle, whichever occurs first.

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To return to straight-and-level flight from a climbing attitude, start the level-off approximately 50 feet below the desired altitude. Apply a slight forward pressure on the cyclic to lower the nose to a cruise attitude. Hold your normal climb power setting until you have reached the desired altitude. Adjust collective pitch to re-establish your cruising manifold pressure and hold the desired altitude. Apply a slight amount of right pedal to keep in trim.

Things to Remember:

As the climb or level-off is started, the airspeed changes gradually. This change in airspeed is gradual rather than immediate because of momentum. Always start or terminate a climb by establishing the appropriate attitude and letting the airspeed gradually assume the desired reading. Rushing will result in overcontrolling.

NORMAL DESCENT

Purpose:

A descent is a maneuver to lose altitude at a controlled rate while in a controlled attitude.

Preparatory:

The normal descent is practiced in the Pre-solo stage of training to develop your coordination and technique. This will prepare you for other maneuvers (traffic patterns and approaches) that utilize similar technique.
You will normally enter a normal descent from straight-and-level flight.

Technique:

To establish a normal descent, (1) apply downward pressure on the collective pitch and maintain RPM; (2) at the same time, apply pressure on the right pedal to counteract the decreased torque effect; (3) simultaneously apply a slight aft pressure to raise the nose to a descending attitude.

To return to straight-and-level flight from a descent, at approximately 50 feet above the desired altitude, apply upward pressure on the collective pitch to stop the descent at the desired altitude. Adjust nose attitude to a straight-and-level attitude.

Things to Remember:

The altimeter has a slight amount of lag, so the initial application of collective pitch must be made before the altimeter actually shows the desired altitude to avoid passing below it. The amount of lead depends on the rate of descent.

CLIMBING AND DESCENDING TURNS

Purpose:

Climbing and descending turns are maneuvers used to change direction of flight while climbing or descending.

Preparatory:

In order to practice climbing or descending turns, align the aircraft with the road or section line on the ground and turn perpendicular or parallel to this line. In the absence of good section lines you may make precision 90-degree turns by selecting a point directly out one door and simply turning to that point. This is a very good method because you will automatically clear the area in the direction of the turn when you select the 90-degree point.

Technique:

To establish a climbing turn, use the same procedure used to establish a normal climb; but as the nose rises, coordinate pressure laterally on the cyclic so the bank will be established simultaneously with the climb attitude. If perfectly established, the climb and bank attitudes will be attained at exactly the same time. Since this does not always occur, hold whichever one that is attained first, then effect the other.

maintaining hover RPM until light on the skids. Once the helicopter is light on the skids, it may tend to turn to the right or left. A slight adjustment of pedals will get you back on heading. It is also important to eliminate any skidding over the ground before you continue the ascent. This is done with small adjustments of the cyclic; ordinarily a slight amount of rearward cyclic is applied to make a vertical ascent. Continue the upward pressure on the collective pitch until breaking ground. In most cases, this amount of pressure will be sufficient to raise the helicopter to three feet. Make the necessary throttle adjustments to maintain RPM. At the same time, maintain your position over the ground with cyclic and keep the heading with pedals. As you reach an altitude of three feet, adjust collective pitch to maintain altitude. Check for proper engine RPM.

Things to Remember:

Do not apply collective pitch abruptly. If you jerk the helicopter off the ground, you won't be able to maintain RPM. Just take it slow and easy.

LANDING FROM A HOVER

Preparatory:

The helicopter is hovered at three feet above the ground, generally into the wind. Direct your vision to a point about 50 feet to the front. Don't stare directly down at the ground.

Technique:

Begin the descent by applying a slight downward pressure on the collective pitch. As you descend, adjust throttle to maintain engine RPM and use pedal as necessary to maintain heading.
Continue to apply a smooth downward pressure on the collective pitch to establish a constant rate of descent to the ground. As you reach a point about 4 to 6 inches from the ground, the helicopter will tend to stop. Do not overcontrol the cyclic at this point, but continue positive downward pressure on the collective, and the helicopter will move through this ground effect to a touchdown.

When the skids touch the ground, lower collective pitch smoothly and firmly to the full down position and adjust throttle to maintain RPM. Add right pedal as needed to maintain heading. At the same time, apply a slight forward pressure on the cyclic so the helicopter will stay firmly on the ground and the main rotor will be tilted away from the tail boom.

Things to Remember:

Constantly cross-check all visual reference points. Hover the helicopter by maintaining a constant attitude.
Fly by pressures on the controls, and not movement of the controls. A series of small corrections are better than one large correction.

HOVERING FLIGHT

Purpose:

To move the helicopter from point to point within a given area, maintaining proper altitude and RPM.

Preparatory:

Hover at three feet above the ground with proper RPM. Select a near and distant object to line up with.

Technique:

Apply a slight pressure on the cyclic in the direction you wish to move. Hover at a walking speed. At this speed you will maintain ground effect which will reduce the need for excessive power and pedal corrections. Ground speed is controlled with cyclic; altitude is controlled with collective pitch; heading is controlled with pedals.

should be started at this point and planned so a track parallel to and the same distance from the next boundary of the field will be maintained. The degree of bank in each turn may vary due to wind direction and velocity. This process is repeated at each corner.

Things to Remember.

Know the direction from which the wind is blowing.Check smoke or wind trails over water. Remember your wind direction when you take off.
When establishing ground track around the rectangular pattern, it is necessary to vary the angle of bank on each turn. Example: When turning from a downwind leg, the angle of bank will be greater than a turn on the upwind leg. For additional explanation of turning techniques, see "S" Turns.

"S" TURNS

Purpose:

This is a maneuver in which the ground track of the helicopter describes a half circle on both the upwind and downwind sides of a reference line while maintaining a constant airspeed and altitude and correcting for wind drift.

Preparatory:

Evaluate the existing wind condition and velocity. Choose an appropriate reference line such as a straight road, fence, section line, or any predominant feature on the ground. This reference line should be as nearly as possible 90 degrees to the wind and of sufficient length to accomodate several alternate right and left banked turns. Your selection should be over relatively open terrain and with good forced landing areas within reach.

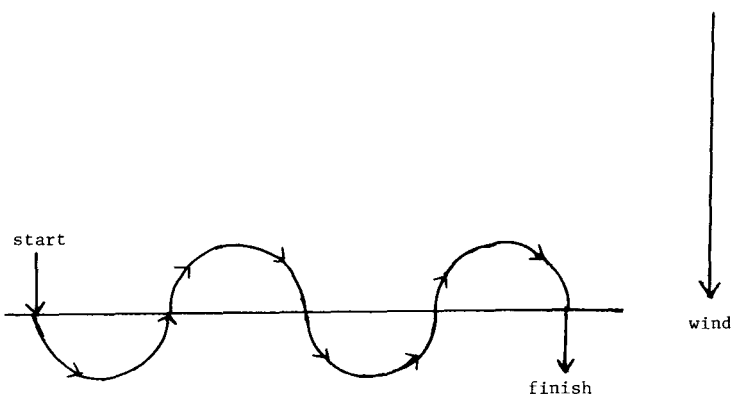
Technique:

At cruising airspeed and at an altitude of 500' above the ground, position the helicopter going downwind 90 degrees to the reference line, straight-and-level. As the helicopter is over the reference line, initiate a degree

of bank commensurate with the wind velocity. A standard radius for the "S" turn is purposely not stated. This radius will depend on wind velocity and proficiency of the student pilot. The stronger the wind, the steeper the initial bank that will be necessary to avoid being drifted beyond the maximum radius. As the turn progresses and the helicopter is heading into the wind, the bank will have to be decreased in order to accomplish a constant radius of turn. As the aircraft approaches the reference line upwind, you should be completing a 180-degree turn of constant radius. As the aircraft is over the reference line, roll from one bank to the next and prepare to execute another 180-degree turn on the upwind side of the reference line equal in radius to the previous turn. The same procedure is followed from one turn to the next, decreasing or increasing the bank as necessary to compensate for wind drift.
Look ahead of the helicopter's flight path and select prominent features on the ground that approximate a uniform radius of turn. The best features to select should be at the apex of the turn and the next point of interception on the reference line.

Things to Remember:

Divide your attention; watch in front of you and all sides for other aircraft.



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SIMULATED FORCED LANDINGS

Purpose:

Simulated forced landings will prepare you to act promptly and efficiently in an emergency. They will develop accuracy, judgment, planning, technique, and confidence. Normally, you will never know in advance when a simulated forced landing will be given; so be alert at all times.

Preparatory:

An alert pilot is constantly on the lookout for suitable forced landing area. Naturally, the perfect forced landing area is an established landing area. The next best substitute is a hard-packed, smooth road or field with no high objects on the approach end. Since these are not readily found in many places, select the best available area. Avoid selecting fields that contain boulders, ditches, or other features which are not characteristic of a good landing area.
You must be aware of the direction the wind is blowing.

Technique:

The maneuver is begun by your instructor as he reduces the throttle to split the needles. Then, firmly and smoothly, lower the collective pitch all the way to the bottom. Add right pedal to trim the helicopter. At this time you should look at the rotor tachometer to see if the rotor RPM is in the proper range (see rotor RPM in aircraft operating instructions) and call over the intercom "Rotor in the green" or "Rotor not in the green." Maintain a 45 to 50 knot attitude. Hold the collective pitch in the full down position, except as necessary to control rotor RPM. Your instructor will adjust the throttle to maintain engine RPM (shown in appropriate aircraft operating instructions). If you are flying downwind or crosswind, make an autorotative turn into the wind. Knowing the direction of the wind is most important. Maneuver the helicopter to reach the desired touchdown spot.

Termination of a simulated forced landing will be as follows:
A simulated forced landing will be completed by making a power recovery. You will make a power recovery in sufficient time to prevent flight below 100 feet AGL, (200 feet during night operations). The power recovery will be initiated by joining the engine and rotor needles using the throttle and collective. Should the rotor RPM be high, the recovery should be made by leading with collective and following with throttle as necessary to prevent an overrev. If the rotor RPM is low,join the needles by leading with throttle and following with collective to prevent a low RPM situation on recovery. When the needles are joined, continue adding throttle and collective to the normal climb power setting. Adjust attitude to normal climb.

Things to Remember:

Vary the flight path as necessary to reach the touchdown point. Airspeed may be varied to some extent to change the glide angle. Higher airspeeds produce a longer glide. Lower airspeeds shorten the glide. Caution must be used when slowing airspeed. This should be done at sufficient altitude to prevent speeds of less than 45 knots below 100 feet for actual forced landings. Simulated forced landings will be terminated prior to 100 feet AGL.

NORMAL TAKE-OFF FROM A HOVER

Purpose:

The normal take-off is designed to transition the helicopter from a stationary hover into translational lift and normal climb in the simplest and safest manner. In order to accomplish the maneuver, sufficient power to hover must be available and no high barriers in the flight path to restrict a normal climb-out.

Preparatory:

A normal take-off is executed from a three foot hover. Select two points along the intended take-off path to line up with. These guide points will be very helpful in maintaining the desired ground track. Make a clearing turn to make sure there are no aircraft near enough to prevent a safe take-off. Before starting to move forward, be sure the RPM is proper and engine instruments are in the green. Observe the manifold pressure reading. This will be the climb power setting.

Technique:

To start moving forward, apply a very slight forward pressure on the cyclic. Do not apply too much cyclic, which results in a nose-low attitude. With the nose too low, the helicopter will gain airspeed rapidly and tend to settle because of loss of vertical lift.
When you move out of ground effect, you may have to increase a little collective pitch to maintain three feet of altitude and squeeze on the throttle to maintain RPM.
As you accelerate to effective translational lift (approximately 15 knots), the helicopter will begin to climb, and the nose will tend to come up due to increased lift. At this point, apply forward cyclic to overcome this tendency. Hold an attitude that will allow an acceleration to 40 knots.

As you begin the climb, adjust manifold pressure to normal climb setting (hover power).
In a cross-wind, the helicopter is flown in a slip. Keep the heading straight along the take-off path with pedals, hold the cyclic into the wind to make good the ground track over the guide points.
Continue to increase airspeed to 40 knots decreasing left pedal as airspeed increases. Coordinate airspeed with the rate of climb to reach 40 knots at 70 to 100 feet. At 50 feet, place the helicopter into a crab. You have the right amount of crab if you are making good your ground track over the guide points and the helicopter is level laterally.
As airspeed approaches 40 knots, apply a slight amount of rearward cyclic to establish a 40 knot attitude and continue the normal climb.

Things to Remember:

One objective in making a normal take-off is to use the minimum amount of power to attain effective translational lift and prevent the helicopter from settling as you move forward. Do not destroy the effect of the maneuver by lowering the nose excessively or by applying power to commence a climb before effective translational lift is reached.

TRAFFIC PATTERNS

Purpose:

The traffic pattern is a maneuver designed to systematically establish an even flow of traffic around an area in a disciplined and safe manner. The pattern is rectangular and will be used during practice at stagefields.

Preparatory:

Before entering traffic, check for proper radio frequency and that volume is turned up. Do not ask for landing information unless there is a valid reason to do so. Normally, the landing direction will be determined by wind direction. Traffic pattern altitude should be reached before turning onto entry leg.

Technique:

45-Degree Entry Leg:

Enter the traffic pattern on a ground track of 45 degrees to the downwind leg. The actual entry will be accomplished within the middle 1/3 of the downwind leg. On this leg of the traffic pattern, as well as on all others, look for wind-drift and make necessary corrections so a constant track will be maintained. Adjust your spacing with other helicopters so you will know positively that they will not interfere with your pattern. Remember, if your spacing is too close on the entry or downwind leg, you will be too close on final approach leg. Aircraft on downwind have the right-of-way over helicopters on entry.

Downwind, Base and Final Leg:

The turn from the entry to the downwind leg should be executed so the ground track is parallel to the landing lanes. Fly at 50 knots and 500 feet for the entire downwind leg. There is no set point at which you turn on base leg. This will depend on the spot on which you intend to land and the location of others in the pattern. Initiate the base leg turn, and start descending to 300 feet, reducing airspeed to 40 knots, (500 feet-50 knots, 400 feet-45 knots, 300 feet-40 knots), simultaneously increase

RPM to RPM shown in appropriate aircraft operating instructions for descents below 500 feet. Plan the descent to arrive at 300 feet and 40 knots, using 2/3 of the length of the base leg, maintaining a ground track perpendicular to the stagefield. Plan the base-to-final turn just as you planned the downwind-to-base turn. Plan the roll-out so the turn will be completely recovered as the helicopter is aligned with the lane. Once aligned with a lane, you are committed to that lane. Under no conditions are you allowed to cross over to adjacent lanes. Plan your approach to the most upwind landing panel in your lane, but never over-fly a helicopter in your lane. Landing panels are numbered 1, 2 and 3. Panel 1 is always the first panel on the lane as viewed on final approach. Panel 4 is the last panel on the lane and is used for take-offs only.

Take-Off and Cross-Wind Leg:

The normal climb after a take-off is the first leg of the traffic pattern. Climb at 40 knots straight ahead. Fly the cross-wind leg with the ground track perpendicular to the stagefield. At about 450 feet, apply a very slight amount of forward pressure on the cyclic. You should apply just enough forward cyclic to allow your airspeed to build to cruise airspeed. As your altimeter approaches 500 feet above the terrain, decrease the RPM to the appropriate cruise RPM for your aircraft. At this point, if you have proper spacing from other helicopters and from the field, start to turn onto the downwind leg and adjust power to cruise setting and maintain 50 knots. Adjust ground track to parallel the runway. To exit from the traffic pattern after take-off; once you have established your cross-wind leg make a 45-degree ground track climbing turn away from the stagefield and continue to climb to at least 500 feet above the terrain. Upon reaching 500 feet carefully clear for other traffic, then a turn in any direction away from the stagefield may be made.

Things to Remember:

Before and during entry into the traffic pattern, you must think and plan ahead. You must (1) determine the direction of the landing and analyze the wind conditions by checking the wind tee, wind sock, smoke, or any other indicators available (2) determine the location of aircraft in the traffic pattern. Continue to analyze the wind condition and traffic spacing throughout the remainder of the pattern.
The wind direction and velocity have a tremendous effect on the traffic pattern and landing. It is extremely important that you know how to recognize and gauge its surface speed. Direction, and to some extent, velocity, can be determined from the wind tee, wind sock, smoke, or blowing dust.

STAGEFIELD GO-AROUND PROCEDURE

A go-around is used when continuation of the approach is not feasible. It is a standard procedure to exit aircraft from the traffic without interfering with the normal flow of traffic or creating an unsafe flight condition.
To initiate the go-around, start a normal climb straight ahead, avoid flight over other aircraft, to an altitude 200 feet above that altitude used on downwind. Notify controlling agency by radio and continue straight ahead until well clear of traffic. Re-enter traffic in normal manner.
NOTE: If a go-around is executed on final approach, it should be made prior to losing translational lift.

Deviation from this procedure is allowed only when communications with the control tower is established and clearance to remain in closed traffic is approved. Do not fly into an overcast. If low clouds prevent a climb 200 feet above the downwind leg, use an altitude that is clear and below all clouds.

NORMAL APPROACH TO A HOVER

Purpose:

The purpose of the normal approach is to provide a safe and precise method of terminating the helicopter at a predetermined point. It utilizes a 12-degree approach angle and a constant apparent rate of closure. The approach is terminated at a three foot hover and with no forward movement.

Preparatory:

To prepare for the normal approach, the helicopter should be aligned with the center line of the lane to be used, 300 feet above the ground. You must evaluate the existing wind velocity to determine the airspeed to be used on final. For example, when the headwind component is more than 20 knots, increase the airspeed by 10 knots. This increase of airspeed should be made on the final leg.

The angle of descent remains constant regardless of wind velocity, so in your evaluation of the wind conditions, plan the entry of the approach to start the descent at the proper angle.

During the Pre-solo and Primary stages, you will concentrate your practice of normal approaches at a stagefield. On base leg, slow the aircraft to 40 knots while losing altitude until you are down to 300 feet. Pick out the lane you intend to use and the panel you will approach. As you turn onto final, line up with the lane selected and make sure you maintain a straight ground track in line with the approach panel. You can do this by observing the relation between your flight path and the boundaries of the lane.

In the Pre-solo stage, the approach is made in a slip if you have a cross-wind. As you become more experienced, a crab, a slip, or a combination may be used for most of the approach, but a slip must be used for the last 50 feet. Enter the slip just prior to starting approach, but soon enough to allow ample time to establish the slip before the proper sight picture is attained.

landing. After the helicopter is entirely on the skids, stop pulling the collective pitch. When the aircraft has come to a complete stop and both skids firmly on the ground, lower the collective pitch all the way to the bottom.

Things to Remember:

The collective pitch must be held stationary until the helicopter starts to descend. Lowering the collective pitch could cause an excessively hard landing. Raising the collective would cause excessive RPM loss and a hard landing.

DECELERATING TYPE AUTOROTATION

Purpose:

The purpose of the decelerating type autorotation is to land the helicopter with a limited ground run and without engine power being delivered to the rotor system.
On uneven terrain, over water, or when the available area is restricted in size, a greater amount of deceleration will be necessary to assure little or no ground run. On smooth or even terrain, a lesser degree of deceleration may be executed since some ground run can be accepted.

Preparatory:

On base leg, maintain traffic pattern altitude of 500 feet and 50 knots airspeed, increase RPM to operating RPM below 500 feet. Turn on final aligning with the proper lane at 500 feet, 50 knots and proper RPM. At a point commensurate with the existing wind, you will enter autorotation. If you have a cross-wind, establish a slip prior to entry and maintain the slip all the way to the ground. The point of entry will vary with different wind velocities.

(1) Fly final at 500', 50K, on lane center line.

(2) Lower pitch fully maintaining operating engine RPM, split needles, hold nose straight by adding right pedal.

(3) 45-50K attitude, call out, "Rotor in the green." Pitch down.

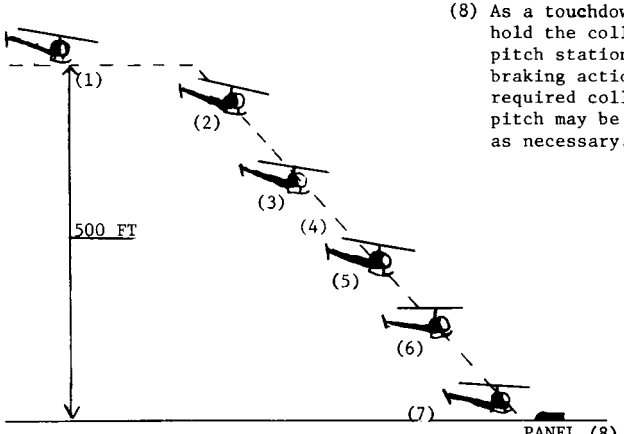
(4) Call actual airspeed.

(5) Over-ride 100 feet.

(6) At approximately 35-50'(OH-23) or 25-35'(TH-55), again check rotor RPM, then execute a deceleration to slow the rate of descent. The amount of deceleration will vary with wind conditions. It should be sufficient so you can definitely feel and see a slowing of rate of descent and ground speed.

(7) At about 10-15'(OH-23) or 4-8'(TH-55), apply sufficient collective to check and slow rate of descent. As the helicopter descends closer to the ground apply additional collective pitch as necessary to cushion the landing, and at the same time coordinate forward cyclic to level the helicopter at touchdown.

(8) As a touchdown is made hold the collective pitch stationary. If braking action is required collective pitch may be lowered as necessary.



Technique:

To initiate an autorotation smoothly reduce the collective pitch to full down position, maintaining the operating engine RPM. When the collective pitch is fully lowered, decrease throttle to split needles and apply right pedal to maintain heading. Use cyclic to keep helicopter lined up with lane and to establish a 45 to 50 knot attitude. Establish engine RPM as shown in appropriate aircraft operating instructions. Maintain 45-50 knots of airspeed. Check to be sure your rotor RPM is in the green and call out "Rotor in the green." (If rotor RPM is decreasing rapidly, make a power recovery and land as soon as possible.) Be sure to hold the collective pitch in the full down position. At about 100 feet check rotor RPM, close the throttle if a safe landing is assured. At approximately 35 to 50 feet (OH-23) or 25 to 35 feet (TH-55) again check rotor RPM, then execute a deceleration to slow the touchdown speed. The amount of deceleration will vary, but should be sufficient and positive enough so that you can definitely feel and see the helicopter slowing.
At about 10 to 15 feet (OH-23), and 4 to 8 feet (TH-55) from the ground, apply sufficient collective pitch to check and slow rate of descent. As the helicopter descends closer to the ground, apply additional collective pitch as necessary to cushion the landing, and at the same time coordinate forward cyclic to level the aircraft. As a touchdown is made, hold the collective stationary. If braking is required, collective pitch may be lowered as necessary.

Things to Remember:

Caution should be used when landing with a strong cross-wind from the left; since the right pedal loses effectiveness as RPM is decreased, you may not have sufficient right pedal to maintain the heading during the ground roll.
The TH-55A has a low-inertia rotor. This results in a rapid loss of rotor RPM when collective pitch is increased. Premature application of collective may cause a loss of control effectiveness and a hard landing.

SECTION IV

PRIMARY I MANEUVERS

MAXIMUM PERFORMANCE TAKE-OFF

Purpose:

The maximum performance take-off is used when a steep angle of climb is required to clear barriers in your flight path. In actual practice, full throttle will be used if necessary; however, in the Primary I phase, the maximum performance power will be restricted to two inches above hover power or full throttle, whichever occurs first.

Preparatory:

The maximum performance take-off is started by executing a clearing turn. Next, with the helicopter headed in the direction of take-off, note manifold pressure reading. Land three feet behind the panel, collective down, reduce RPM; visually clear overhead and to each side. Prior to take-off, apply carburetor heat to clear any possible ice, then move the carburetor heat lever to the full cold position. After clearing all barriers or reaching a safe altitude, adjust carburetor heat as required for continuous operation. Avoid prolonged use of high carburetor heat as it will cause a serious power loss.

Technique:

Increase RPM to take-off setting (see appropriate aircraft operating instructions), and apply upward pressure on the collective pitch, increasing it slowly and smoothly until the helicopter is light on the skids. Hesitate momentarily, neutralize the cyclic to compensate for the load distribution of your aircraft, and stop any ground movement; also make necessary pedal adjustments to maintain proper alignment of the helicopter.

Continue now to apply collective pitch and throttle. As the helicopter breaks ground, pivot into a 30 knot attitude, increase the throttle to the full power position or 2 inches above hover power, whichever occurs first. (Do not exceed 25.2" OH-23G.) Adjust pedals as necessary to maintain heading. Your indicated airspeed at the entry of the take-off will be erratic, so you will not be able to judge your attitude from your airspeed indicator.
Continue your climb in a 30 knot attitude, maintain a straight ground track, and use the pedals to keep the aircraft headed straight. If you have a cross-wind, the helicopter is flown in a slip. At 100 feet, establish a normal climb by lowering the nose to a 40 knot attitude, then slowly reduce the manifold pressure to normal climb power. Properly executed, you should reach 40 knots about the same time you arrive at your normal climb power. At this point, if you have a cross-wind, establish a crab to maintain a straight ground track.

Things to Remember:

The maximum performance take-off is a smooth coordinated maneuver and should never be executed in an abrupt manner. Overcontrolling causes a loss of lift, which decreases the helicopter's performance.
In the event full throttle is used, the collective is used to maintain RPM. (See Low RPM Recovery Emergency Procedures section.)

STEEP APPROACH

Purpose:

The steep approach is used primarily when there are obstacles in your approach path that are too high to clear using a normal approach. It is also used to avoid areas of turbulence around a pinnacle.

NORMAL TAKE-OFF FROM THE GROUND

Purpose:

The normal take-off from the ground is used to move the helicopter from a position on the ground into translational lift and normal climb with a minimum amount of power. The normal take-off from the ground is the most common take-off used in the field.

Preparatory:

Collective pitch full down, reduce RPM; clear behind, overhead, and to each side. Pick out objects in front of the aircraft to line up with during the take-off.

Technique:

Increase to proper RPM and apply upward pressure on the collective pitch, increasing slowly and smoothly until the aircraft is light on the skids. Hesitate momentarily and adjust cyclic and pedals to prevent any ground movement. Continue now to apply collective pitch and as the aircraft breaks ground, use cyclic as necessary to assure forward movement as altitude is gained to 3 feet. As you accelerate to translational lift, the helicopter will begin to climb. Adjust attitude and power, if necessary, to continue the climb in the same manner as a normal take-off from a hover.

Things to Remember:

Starting the take-off too nose low will require excessive power.
You should be able to complete the take-off using no more than hover power under most wind conditions.

APPROACH TO THE GROUND

Purpose:

The approach to the ground is used when it is known or suspected that sufficient power is not available to terminate at a 3 foot hover. This approach is most commonly used when:

Landing a helicopter fully loaded.
Landing at a high density altitude condition.
Landing in loose snow or dust.

Preparatory:

Note - Same as Normal Approach.

Technique:

Same as the Normal Approach except for the termination. The approach should be terminated to the ground 3 feet behind the panel with no ground run. The skids should be level as ground contact is made. Lower collective pitch to full down position, maintaining hover RPM. A constant angle of 12 degrees should be maintained.

Things to Remember:

Continue the approach angle all the way to touchdown with no forward movement on ground contact.

QUICK STOPS

Purpose:

This maneuver requires the use of all the controls simultaneously. It is designed to bring the helicopter to a stationary hover from forward flight.

Preparatory:

Before starting the maneuver, the wind direction and velocity should be evaluated as these will have a bearing on the distance required to stop the helicopter once the deceleration is initiated.

Technique:

Begin the maneuver from a 3-foot hover into the wind and at hover RPM. Start in the same manner as if you were making a normal take-off. As the helicopter starts to climb, continue to an altitude of 25 feet. Level off at 25 feet and continue to accelerate to 40 knots. If cyclic is applied too fast, the helicopter will start to climb; if you apply cyclic too slowly, you will descend prematurely. When you lower the collective pitch, apply right pedal to maintain heading and adjust throttle to maintain proper RPM. Continue to hold aft cyclic until the helicopter has decelerated to a rate of closure equivalent to a brisk walk. Maintain a slight nose high attitude and as the helicopter continues to descend, start applying positive upward pressure on the collective pitch to control the descent. Use the left pedal to maintain heading. Continue to apply pitch and throttle to stop the descent, level the helicopter and terminate at a stationary 3-foot hover.

Things to Remember:

Avoid an excessive tail low attitude too close to the ground. Use only designated areas to perform this maneuver.

DECELERATION EXERCISES

Purpose:

The purpose of this exercise is to provide a practice maneuver which requires maximum coordination of all controls.

Preparatory:

Begin the exercise headed into the wind at an altitude of approximately 500 feet and an airspeed of 50 knots. Deceleration exercises are performed over open terrain in case a forced landing is required. Maintain cruise RPM throughout the maneuvers.

Technique:

Start the maneuver by making a slight reduction in collective pitch, followed closely by a slight rearward pressure on the cyclic. The idea is to slow your airspeed and maintain altitude. The rearward movement of the cyclic must be exactly timed to the lowering of the collective pitch. If you apply rearward cyclic too fast, the aircraft will start to climb. If you apply cyclic too slowly, you will lose altitude. When you lower the collective pitch, apply right pedal to maintain your heading. Adjust the throttle to maintain proper RPM.
Continue to hold rearward cyclic until you decelerate to an airspeed of 30 knots. Maintain altitude, heading and RPM.
Begin the recovery by applying a slight upward pressure on the collective pitch and applying forward pressure on the cyclic until the helicopter starts to accelerate. Maintain this attitude until cruising speed is reached. Do not let the nose get more than a few degrees below a level attitude; otherwise, you may have to use excessive power to keep from losing altitude.

Things to Remember:

Be alert for other aircraft in the area.

180 DEGREE AUTOROTATION

Purpose:

The purpose of the 180-degree autorotation is to fly the helicopter through 180 degrees of turn in a coordinated manner while in autorotation.

Preparatory:

To practice 180-degree autorotations, fly the downwind leg close to the lane at an altitude of 500 feet and an airspeed of 50 knots. Maintain hover RPM on downwind leg. If you have a cross-wind, correct for drift by crabbing.

Technique:

Begin your 180-degree autorotation when the helicopter is approximately opposite the area where you intend to land. Lower the collective pitch to the full down position while maintaining operating engine RPM, then decrease throttle to split the needles and apply right pedal to maintain heading. Do not use pedal to assist your turn.
It is best to make the first half of the turn as soon as possible. This allows you time on the last half of the turn to vary the degree of bank in order to make your intended landing area. Cross-check the rotor RPM. In autorotative turns, the rotor RPM may tend to overspeed and it will be necessary to increase the collective pitch slightly to avoid exceeding RPM limits. When collective pitch is used to avoid a rotor overspeed, you must return it to the full-down position before RPM has decreased below the safe operating range. At about 100 feet, check rotor RPM and call out "Rotor in the green." If a safe landing is assured, completely close the throttle. If there is doubt that a safe landing can be made, execute a power recovery and go-around. The attitude during an autorotative turn is very important, for a nose low attitude will cause a high rate of descent. An attitude similar to that used in a straight-in autorotation should be maintained in the turn. The turn should be completed at about 75 to 100 feet above the ground. The termination technique will be the same as for the decelerating autorotation.

Things to Remember:

The position of the downwind leg in relation to the lane is governed by the wind direction and velocity. If the direction of the cross-wind is blowing you toward the field, the downwind leg should be placed further from the field than normal. If the cross-wind is blowing you away from the field, the downwind leg should be placed closer than normal.

RUNNING TAKE-OFF

Purpose:

The running take-off is used when insufficient power or a heavy load makes a normal take-off impossible. This situation exists when the helicopter cannot hover more than one foot off the ground at full power without loss of rotor RPM. If at full power the helicopter cannot hover, a take-off should not be attempted.

Preparatory:

The running take-off is begun with the execution of a clearing turn; with the aircraft headed in the direction of take-off and at a three foot hover note the manifold pressure, then land three feet behind the panel and heading in the direction of take-off. Place collective full down; reduce RPM, visually clear overhead and to each side.

Technique:

Increase RPM to take-off setting (see appropriate aircraft operating instructions). Place the cyclic slightly forward of the neutral position; neutralize the pedals and pick out an object to line up with for take-off run. Smoothly apply collective pitch maintaining proper RPM. Manifold pressure used will be that manifold pressure required to hover minus one to two inches. As the manifold pressure nears the value selected, the helicopter will begin to taxi forward along the ground. Maintain heading with the pedals, directional control with the cyclic; use collective pitch to control starting, stopping and rate of speed over the ground. Continue to increase collective pitch until the maximum allowable range established above is reached. As forward speed increases to about 12-15 knots, the helicopter will become increasingly light on its skids and will begin to skip along the ground. At this time apply a slight amount of aft cyclic pressure to become airborne. At an altitude of about 10 feet, lower the

nose and accelerate to 40 knots; just prior to reaching 40 knots, apply aft cyclic. Climb to 50 feet at 40 knots maintaining manifold pressure and pitch setting. At 50 feet, establish a normal climb placing the helicopter to crab into a cross-wind if necessary.

Things to Remember:

The use of a manifold pressure reading which is one to two inches below hovering power simulates an overload condition.

SHALLOW APPROACH AND RUNNING LANDING

Purpose:

The shallow approach and running landing are used when it is not possible to terminate the approach at a hover, because of heavy loads or insufficient power.

Preparatory:

The shallow approach is begun 300 feet above the ground and at 40 knots. A five-degree angle of sight is used for this approach.

Technique:

After turning final, look for the shallow approach sight picture(5 degrees). As the sight picture approaches, start to descend by lowering collective pitch, control airspeed with cyclic and maintain direction with cyclic and pedals. At approximately 50 feet from the ground, very gradually apply aft cyclic to dissipate airspeed. Since effective translational lift diminishes rapidly as airspeed decreases, forward airspeed must be maintained until touchdown. Smooth coordination in the operation of slowing the helicopter down and at the same time maintaining translational lift will prevent abrupt settling. Prior to making contact with the ground, the helicopter

is placed in a straight-and-level attitude by application of pedals, cyclic and collective pitch controls. Touchdown will be made slightly beyond the panel selected for a touchdown point. Pedals are used to maintain heading, cyclic control to maintain track and level attitude, collective pitch to cushion the landing. After ground contact place the cyclic control slightly forward of neutral to tilt the main rotor away from the tail boom. Normally the collective pitch is held stationary after touchdown; however, if braking action is desired, collective pitch may be used as necessary. Appropriate RPM must be maintained until the helicopter is stopped.

Things to Remember:

In the shallow approach, airspeed and not ground speed is the most important consideration. Overcontrol of cyclic and other controls during the final portion of the approach will cause settling.
An increase of airspeed on final should be made for wind in the same manner as outlined for a normal approach. A crab may be used for most of the approach if a cross-wind exists, but a slip must be used for the last 50 feet.

determining the approach path into and out of the area. Check the barriers for height and location. Make note of the long axis of the area.
Select an approach path generally into the wind and over terrain that minimizes the time that you are not in reach of forced landing area. If possible, you should make a normal approach. High barriers will require a steeper approach angle.
The touchdown point will normally be in the upper third of your area. Make your approach sufficient to clear the barrier by 10 feet and reach your landing spot on a constant angle.
Select a take-off path into the wind if possible. But again, it is sometimes better to fly at an angle to the wind and have a forced landing area available than to fly directly into the wind without such an area. While in the air, pick out check points to keep well oriented when you are on the ground. On the ground, you should be able to find the exact take-off path that you selected in the air.

Things to Remember:

Divide your attention between flying the helicopter, looking at the area, and remaining clear of other aircraft. Maintain proper airspeed and RPM.

If the wind is favorable, plan to approach and take off over the lowest obstructions, and try to utilize the length of the area for the take-off and approach.

Use your own judgment when working a confined area or pinnacle. There is normally more than one solution in working any area, so learn to use your judgment in evaluating the existing factors, and profit from your instructor's experience when he suggests a better method for working a particular area.

LOW RECONNAISSANCE AND APPROACH

Purpose:

The primary purpose of the low recon is to confirm what you observed on the high recon and to locate an obstruction not visible before. A secondary purpose of this maneuver is to position the helicopter on the final approach leg for landing.

Preparatory:

To prepare for a low recon and landing, descend to an altitude 300 feet above the terrain and slow airspeed to 40 knots. Increase RPM to operating RPM for descents below 500 feet. This portion of the maneuver is the base leg and conducted either cross-wind or into the wind. Dissipate airspeed and altitude evenly across this leg. From this altitude and airspeed, position yourself on the selected final approach leg. Do not descend with a downwind condition. When the collective is lowered to begin the approach, the low reconnaissance begins.

Technique:

As you begin the low recon and final approach, confirm your evaluation of the landing zone and angle of approach. It may be necessary to maneuver the helicopter on final to take advantage of terrain along the approach path. The low recon is continued throughout the approach until touchdown in the upper usable third of the area. Do not exceed a steep approach angle when landing in a confined area. The approach should be as near normal as possible. On short final, you should determine if the approach will be terminated at a hover or to the ground. If the touchdown point you have selected is clear of obstruction and not excessively rough, the approach should be made to the ground. Make sure there are no wires, limbs, or barriers that your angle of approach will not clear by 10 feet.
If a go-around is made on the low recon, it should be made prior to loss of translational lift and before descending below the level of surrounding barriers.
The go-around will be initiated by applying climb power and adjusting the nose to climb attitude.
As the helicopter touches the ground, slowly lower the collective pitch and maintain RPM until the pitch is completely down. At this time, slowly move the cyclic and pedals to determine the stability of helicopter. If there is doubt of stability, or the helicopter moves during cyclic movement, adjust your position on the ground until a stable position exists.

Things to Remember:

The low recon is continued until touchdown in the confined area. The landing is made in the upper third of available area and terminated to the ground if terrain permits.

GROUND RECONNAISSANCE

Purpose:

To determine the amount of area needed and the amount available to maneuver a helicopter in a confined area and insure safe maximum use.

Preparatory:

Before getting outside of the helicopter make stability check, level the rotor disc with the apparent horizon, reduce engine RPM to proper setting, place the carburetor air in cold position, (OH-23), and apply friction to all controls. (Use the mechanical lock.) Caution - when exiting the helicopter, be careful not to walk upslope under the main rotor.

Technique:

The ground recon can be broken down into four steps as follows:

a. Initial wind check: Move directly forward of the helicopter to the most upwind position of the area. Check the wind by throwing grass or dust into the air and observe the direction in which it is blown.

b. Area survey:

(1) Survey area while walking from upwind position to downwind position. Check for:

(a) Obstructions (rocks, bushes, stumps).

(b) Slopes, if present.

(2) Determine downwind barrier.

(3) Determine take-off path, considering:

(a) Possible low barriers at upwind end of area along take-off path.

(b) Departure path selected during high reconnaissance.

(4) Determine take-off point and ascertain tail rotor clearance by pacing off the distance necessary for maneuvering the helicopter plus a safety margin of 10 feet (3 or 4 paces). Use a marker you can recognize easily and is heavy enough to not be blown by rotor wash, but do not build large mounds which could hinder hover flight.

(5) Determine the radius of the main rotor plus a 10 foot safety margin (3 or 4 paces).

(6) Determine main rotor clearance by pacing from the barriers to a point which will approximate the position of the mast when the helicopter is three feet behind the markers.

c. Hover plan:

If the area is wide enough, plan to turn the helicopter around a turn-around marker and hover straightforward. Hover rearward only when the helicopter cannot be turned around or wind is in excess of 15 knots in area. Sideward hovering is limited to only that distance necessary to afford proper clearance to complete a turn.

d. Final wind check:

Return to the upwind portion of the area and recheck the wind to insure that the wind has not shifted.
Ground markers used for turning the helicopter will be kept in sight at all times and all turns will be made around the marker. The ground markers for rearward hovering will be placed along either skid rather than directly beneath the helicopter. This is to obtain the best possible view of the markers. Rearward hovering markers will include a prepare-to-stop marker, 3 to 4 paces in front of the marker indicating the take-off point.

Things to Remember:

Do not use markers positioned by other students. Do not build large mounds which could hinder hovering flight. Precision hovering at normal hover altitude is desired unless a lower hover is required to conserve ground effect. Avoid turning the tail upslope. Avoid hovering close to rocks or stumps that could hinder the safe operation of your helicopter. Remember your hovering plan and execute it confidently and exactly.

TAKE-OFF FROM A CONFINED AREA

Purpose:

The primary purpose of this take-off is to depart a confined area utilizing proper techniques that will clear barriers by 10 feet.

Preparatory:

Release sufficient friction on the throttle and remove mechanical lock on collective (adjust carb heat, OH-23), and make a magneto check to be sure the engine is running properly and the plugs did not foul while the engine was at reduced RPM, reduce RPM below green limitation. Release remaining friction from all controls. Then hover to your take-off point, using your ground markers to guide your flight. Make all turns around the appropriate marker. Check your hover power and set the helicopter down slowly. Just prior to take-off, clear behind and overhead for approaching aircraft. Prior to take-off, apply carburetor heat to clean any possible ice, then move the carburetor heat lever to the full cold position. After clearing all barriers or reaching a safe altitude, adjust carburetor heat as required for continuous operation. Avoid prolonged use of high carburetor heat as it will cause a serious power loss.

Technique:

Take off from the ground in a 30 knot attitude using two inches above hover power or full throttle, whichever occurs first. Use RPM shown in appropriate aircraft operating instructions. The confined area take-off, executed in the proper manner, should not require more than 2 inches above hover power. (Never exceed 25.2 inches of manifold pressure in the OH-23G.) The take-off path should be over the lowest barrier that allows you to take advantage of the wind and terrain. Clear the barrier by 10 feet, both vertically and horizontally. After clearing the barrier, resume a normal climb in the same manner as at a stagefield.

Things to Remember:

Consider what effect the existing wind condition will have on your take-off and take-off path. Cross-winds of 90 degrees are treated as a no wind condition and will affect the amount of pedal available for take-off.

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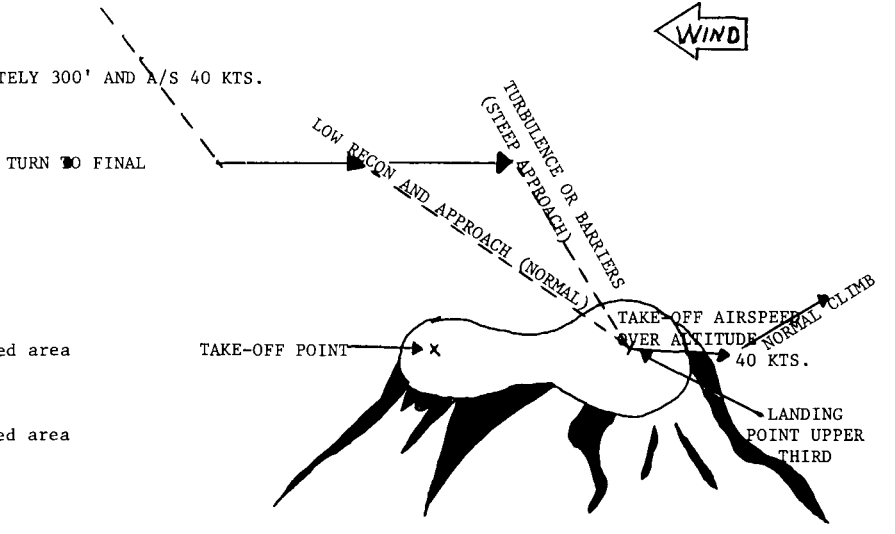
PINNACLE OPERATION

500' AT 50 KTS.

HIGH RECON AT 500' AND 50 KTS.

1. NORMALLY, A CIRCULAR HIGH RECON PATTERN IS USED.
2. THIS PATTERN MAY BE FLOWN IN ANY DIRECTION.

BASE LEG
DESCEND TO APPROXIMATELY 300' AND A/S 40 KTS.



HIGH RECONNAISSANCE:
Same as for confined area operation.

LOW RECONNAISSANCE:
Same as for confined area operation.

APPROACH TO A PINNACLE

Purpose:

The purpose of the pinnacle approach is to terminate in the safest manner avoiding turbulent areas around the pinnacle.

Preparatory:

The preparation for the approach is made on the high recon. At this time, the pattern is planned and the type of approach to be used is determined. A normal approach angle is normally made to pinnacles. If winds are strong and turbulence is expected, a steep approach should be made to better avoid downdrafts on the downwind side. Should the pinnacle be in the form of a ridge line, the best approach path is usually along the ridge line. Barrier height and location will also be a factor in selecting the approach angle.

Technique:

The approach is started at the airspeed and RPM outlined in normal approaches (Primary I maneuvers). The approach (same as confined area) is made to the upwind third of the available area and to the ground if the area is suitable. If the terrain is rough or uneven, the approach should be terminated at a hover. If excessive turbulence is encountered during the approach, execute a go-around and select a different approach path to the pinnacle. If excessive turbulence cannot be avoided, do not land on the pinnacle.
After touchdown, the helicopter is frictioned down in the same manner as the procedure used in confined areas.

Things to Remember:

Make sure the skids are completely on the pinnacle before lowering the collective.

GROUND RECON

The same techniques as outlined for confined areas will be followed. In selecting the take-off point, care must be exercised to insure placing the skids entirely on the pinnacle. The tail rotor or tail boom may extend over the drop-off, but not any part of the skids.

PINNACLE TAKE-OFF

Purpose:

To depart the area in the safest manner, minimizing the time in which a safe autorotation could not be executed.

Preparatory:

Release sufficient friction on the throttle, remove mechanical lock on collective, and make a magneto check. Release remaining friction and execute the hovering plan. Prior to take-off, clear the area for other aircraft. Apply carburetor heat to clear any possible ice, then move the carburetor heat lever to full cold position. After clearing all barriers or reaching a safe altitude, adjust carburetor heat as required for continuous operation. Avoid prolonged use of high carburetor heat as it will cause a serious power loss.
A pinnacle take-off is an airspeed-over-altitude take-off and made from a hover. This take-off will be made from all pinnacles when the ground under the take-off flight path is significantly lower than the take-off point. When the take-off flight path is over terrain of the same or greater height, or when barriers are present, the area should be treated as a confined area.

Technique:

To initiate this take-off, hover at three feet and head in the direction of take-off, using hover RPM. Check hovering manifold pressure. This will be the take-off power. Clear yourself and initiate the take-off with forward cyclic to attain forward movement and as the helicopter moves out of ground effect, it may be necessary to add a slight amount of collective pitch to maintain three feet. Maintain RPM, altitude, and continue to gain airspeed.

At translational lift, reduce power to hover manifold pressure setting if additional collective was used earlier to prevent settling below three feet. Maintain altitude and accelerate to climb airspeed. Lead the airspeed indicator about 5 knots to prevent exceeding climb airspeed.
By gaining airspeed quickly, the time spent over unfavorable terrain is minimized.

Things to Remember:

Do not dive off the edge of the pinnacle.

SLOPE OPERATION

Purpose:

To land the helicopter in the safest manner on terrain that is not level.

Preparatory:

Helicopters with skid type landing gear are properly landed cross slope. If necessary because of barriers, the helicopter may be landed upslope, provided the slope is shallow. Never land downslope because of the possibility of the tail rotor contacting the ground.
Slope landings will be conducted cross slope and into the wind as much as possible, but never downwind. The maximum slope used will be 8 degrees.

Technique:

Hover the helicopter slowly toward the slope, keeping the skids parallel to the slope. Do not turn the tail of the helicopter upslope. Hover into position three feet above the intended touchdown point and focus your vision out in front of the helicopter. Use hover RPM.
Begin the slope landing by a slight downward pressure on the collective pitch to start the helicopter descending slowly. As the upslope skid contacts the ground, apply cyclic pressure in the direction of the slope and lower the collective slightly to hold the skid at this position.

Continue to lower the collective slowly, using additional cyclic as necessary to prevent movement. Use caution and do not apply too much cyclic or mast bumping will occur (in the OH-23D). Maintain heading with pedal. When the downslope skid is on the ground, continue to slowly lower the collective until fully down, maintaining RPM. If you intend to exit the helicopter or intend to reduce RPM, check the stability of the helicopter by moving the cyclic in various directions before reducing RPM. Trim the cyclic into the slope if exiting the helicopter.
The procedure for take-off is almost the exact reverse of that for landing. Maintain hover RPM and move the cyclic in the direction of the slope. Raise the collective pitch slowly, maintaining RPM and heading, and coordinate cyclic movement toward the neutral position as the lower skid begins to rise. Apply additional collective and coordinate cyclic movement to lift off straight up to a hover. Depart the slope with the skids parallel to the slope. Do not turn the tail upslope.

Things to Remember:

Overcontrol and overuse of the cyclic may result in mast bumping as well as landing on a slope that is too steep (OH-23); however, if the slope is too steep, abort the attempted landing. Do not walk upslope into rotor blade.

SECTION VI

EMERGENCY PROCEDURES

GENERAL PRECAUTIONARY RULES

1. Do not perform acrobatic maneuvers.
2. Do not check magnetos in flight.
3. Do not adjust mixture control in flight.
4. Always taxi slowly.
5. Make sure all loose objects in the cockpit are secured.
6. Lock shoulder harness in an emergency situation.

OVERSPEEDS

All overspeeds require that an entry be made on the aircraft DA Form 2408-13. This entry should include the maximum indicated RPM, the circumstances of the overspeed (i.e., during hover, during start, during power recovery, etc.) and the length of time in seconds. The amount and duration of any overspeed must be honestly and accurately recorded to include engine and/or rotor RPM indicated at the time of overspeed.

TACHOMETER FAILURE

Helicopters are equipped with dual tachometers. One needle indicates engine RPM and the other rotor RPM. If either needle should fail, the other will provide the information necessary to safely continue flight and land the helicopter at the nearest stagefield or heliport. You should not enter autorotation if the engine RPM needle suddenly goes to zero unless the engine has actually stopped.

FROZEN THROTTLE EMERGENCY PROCEDURE

A frozen throttle in flight is an emergency condition where the pilot must evaluate the conditions and decide on the type emergency procedure to follow. The throttle may freeze under any power setting from full throttle to reduced power as in a normal descent. An evaluation of the power being applied as the throttle freezes will be the best guide to the pilot as to emergency procedure to follow.

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Upon recognition of a frozen throttle, contact the controlling radio and declare an emergency. Advise him of your difficulty and stand by for his instructions. A frozen throttle condition will require some experimentation to determine if a descent can be established and executed without getting an excessive engine over-rev and/or low RPM condition. If the descent can be established, the shallow approach to a running landing should be used. The descent should be kept at a slow rate, controlling RPM with use of collective pitch and touchdown made. Continue to maintain engine RPM with collective pitch after touchdown and shut off magneto switch to stop the engine. NOTE: In case the frozen throttle condition will not allow a descent without a dangerously high RPM, an autorotation must be accomplished. Turning off the magneto switch is the most efficient method to stop the engine under these conditions. To accomplish this, secure the collective by applying pressure to it by the left leg and knee, quickly place the mag switch in the "off" position and return the left hand to the collective. Lower the collective and complete the autorotation as outlined in Page III-27.

LOW RPM RECOVERY

A low engine RPM can occur while hovering or in flight. During the early stages of training, it is normally caused by improper throttle usage, throttle-pitch coordination, or throttle-pedal coordination.
You may be confronted with low engine RPM and should learn how to properly recover from this condition. The instructor will demonstrate the proper methods of recovery. A review of the procedures is listed below.
Hovering - A low engine RPM while hovering can be the result of improper throttle usage, throttle-pedal coordination, hovering in a strong crosswind, (or downwind), hovering in turbulence created by other helicopters, etc. Your first reaction should be to increase throttle to regain proper RPM. If it is apparent you are against the stop (full throttle), you should reduce or lower collective pitch. This should be done cautiously so you do not make hard or drifting contact with the ground. If, by reducing collective pitch and hovering closer to the ground, you are still unable to regain operating RPM, then land the helicopter, making sure you are level and straight. With the collective pitch down, regain operating RPM with the throttle and pick up to a hover in the normal manner.

In flight - A low engine RPM in flight can be the result of improper throttle usage or throttle-pitch coordination. It can occur in cruise, climbs or descents. The position of your collective pitch should be your guide as to the recovery method. If you were in cruise or descents (approaches), the low RPM was probably caused by improper throttle usage. Your first reaction should be to increase throttle, followed by relaxing any up collective pitch pressure you may be holding. If you were in a climb, the low RPM was probably caused by improper throttle-pitch coordination. Your first reaction should be to relax or reduce collective pitch, followed by increasing throttle as necessary.
A thorough knowledge of the above techniques are necessary before solo and any questions should be clarified by your instructor prior to that time.

CARBURETOR ICING

Carburetor icing is a frequent cause of engine failure. The vaporization of fuel, combined with the expansion of air, causes a sudden cooling of the mixture. Water vapor may be deposited by the sudden cooling and may freeze in the carburetor passages. Even a slight amount will reduce power and may lead to complete power failure.

CARBURETOR HEAT CONTROL IN FLIGHT

In addition to the preflight warm-up checks, carburetor air temperature needs to be frequently rechecked. This is especially true just before take-off and when you are using cruising power.

CAUTION

Do not apply carburetor heat when OAT (outside air temp) is above 40 degrees C (104 degrees F).

OH-23

Instrument: On the OH-23 helicopter, the carburetor air temperature gauge is divided into three parts as follows:

Green Arc - 32 to 54 degrees Centigrade: Desired operating range.
Yellow Arc - 0 to 31 degrees Centigrade: Caution operating temperatures.
Red Mark - 54 degrees Centigrade: Maximum operating limit.
Indications: The best indication of a need for carburetor heat occurs when the needle on the carburetor air temperature gauge is not in the desired operating range. Additional indications are (1) when the engine runs rough, and (2) when you have an unexplainable loss of RPM. Correction: Apply sufficient carburetor heat to bring the carburetor air temperature needle to the desired operating range. For continuous operation, 45 degrees Centigrade is the recommended temperature.

GROUND RESONANCE

TH-55A

Ground resonance is a vibratory condition present in the helicopter while on the ground with its rotor turning. Usually, the helicopters with fully articulated rotor systems are susceptible to ground resonance. Ground resonance occurs when unbalanced forces in the rotor system cause the helicopter to rock on its landing gear at or near its natural frequency. The design of the helicopter is such that, with all parts operating properly, the landing gear oleos and rotor blade dampers will, by energy dissipation, prevent the resonance from building up to dangerous proportions.

Conditions causing ground resonance:

a. Improper inflation of oleos.
b. Defective dampers.
c. Operation of high power with the heliocpter very light on the gear.

NOTE: If ground resonance is allowed to build, it may cause destruction of the helicopter.

Recovery from partial ground resonance:

a. During engagement: If symptoms are encountered during engagement, discontinue the engagement, shut down helicopter and check for possible cause.

b. If encountered while operating in partial contact with the ground: Recover by taking off to a hover if at sufficient RPM. When the RPM is too low to take off, lower the collective full down, close the throttle, and shut the engine off.

TAIL ROTOR FAILURE IN FLIGHT

Immediately close the throttle and lower the collective to maintain directional control. After directional control is established, cautious application of power may be made if necessary to lengthen the glide. Maintain an airspeed of at least 40 knots. Correct the torque effect of the main rotor by applying cyclic control slightly away from the direction in which the helicopter tends to turn. Make a normal autorotative landing into the wind, if possible, on a straight flight path. When making an autorotative landing because of tail rotor failure, forward speed at the time of ground contact is desirable if the landing surface is sufficiently smooth. NEVER apply power during the actual landing operation.

ANTI-TORQUE FAILURE FROM A HOVER

Purpose:

The purpose of this demonstration is to enable you to recognize the effects on the helicopter of anti-torque failure while hovering, and to understand the proper recovery technique.
If the anti-torque system fails while hovering, immediate action must be taken by the pilot to avert serious difficulties. The helicopter will begin to turn to the right and the rate of turn will build rapidly due to torque forces produced by relatively high power settings.

Preparatory:

To demonstrate this maneuver, the helicopter is hovered at three feet and 90 degrees to the left of wind direction.

Technique:

With the cross-wind from your right, begin a pedal turn to the right using the amount of right pedal necessary to establish a faster-than-normal rate of turn. (Safety dictates the amount of pedal used for a safe completion of the maneuver.) The cyclic is used to prevent drift. When 90 degrees of turn have been completed and the helicopter is into the wind, close the

Things to Remember:

Do not allow the rate of descent to build to unnecessary proportions.

The nose of the helicopter will, on some occasions, drop violently. Do not pull too far back on the cyclic at this point or the rotor blades may contact the tail boom.

ROUGH ENGINE PROCEDURES

a. If the engine is rough to a point of the needles splitting (engine tach needle and RPM needle), make an autorotation to the most suitable area available, using proper autorotative techniques, and await assistance. After the autorotation is entered, do not attempt to return to powered flight.

b. If the engine is rough but the needles remain joined, even though it may necessitate reducing power by lowering collective, maintain a speed slightly faster than a normal approach and make a power-on landing to the most suitable area available, and await assistance.

IN-FLIGHT ELECTRICAL SYSTEM FAILURE
OH-23 and TH-55

Complete failure of the electrical system is improbable because primary DC power will be supplied by the battery in the event the generator fails; however, any nonessential electrical equipment should be turned off to conserve battery power. It is important to remember that complete electrical failure will NOT affect the operation of the engine or rotor tachometer. If an electrical failure occurs, the following procedure will be followed:

a. Generator (OH-23 or Alternator (TH-55) Failure:

(1) Check circuits breakers - IN (OH-23).

(2) Re-cycle generator or alternator switch: OFF, then ON (TH-55).

(3) If generator or alternator power is not restored, turn generator or alternator switch - OFF (pull generator circuit breaker OH-23).

(4) All non-essential electrical equipment - OFF.

(5) Return to stagefield or heliport and land (radio may be operated on battery power for the purpose of obtaining landing instructions).

b. Complete Electrical Failure:

(1) All circuit breakers - IN.

(2) Re-cycle generator or alternator and battery switches - OFF, then ON.

(3) If electrical power is not restored, all electrical switches - OFF (pull generator circuit breaker, OH-23).

(4) Return to heliport or stagefield as soon as possible, utilizing normal pattern procedures, and land.

WARNING LIGHTS

OH-23 Generator Warning Light.

On the ground: Shut the helicopter down, call for maintenance and make entry in the 2408-13.
In flight: Continue flying, pull the generator circuit breaker and proceed to land at the nearest refueling area, stagefield or heliport. Make appropriate entry on the 2408-13.

All Other Warning Lights, OH-23 and TH-55.

On the ground: Shut down, call for maintenance and make entry in the 2408-13.
In flight: Maintain a speed slightly faster than a normal approach and make a power-on landing to the most suitable area available, make appropriate entry in the 2408-13 and await assistance.

FIRES

ENGINE FIRE DURING START-UP

1. If fire breaks out during the engine starting procedure immediately discontinue priming the engine but continue to engage the starter in an attempt to draw the fire through the engine.

2. If the fire continues or spreads, release the starter and close the fuel shut-off valve.

3. Fight the fire with fire extinguisher.

4. Be sure all electrical switches are off before leaving the helicopter.

5. Do not attempt to restart the engine.

ENGINE FIRE IN FLIGHT

Immediately on discovery of engine fire during flight, enter autorotation, prepare for a power-off landing and:

a. Turn OFF fuel valve.

b. Pull mixture control (if equipped) to IDLE CUTOFF.

c. Turn OFF magneto switch.

d. Turn OFF battery (master) switch.

e. LOCK shoulder harness.

f. Execute autorotative descent and landing.

Do not restart engine until cause of fire has been determined and corrected.

ENGINE FIRE DURING FLIGHT (LOW ALTITUDE)

Immediately accomplish the following:

a. LOCK shoulder harness.

b. LAND immediately.

c. Turn OFF fuel valve.

d. Pull mixture control (if equipped) to IDLE CUTOFF.

e. Turn OFF magneto switch.

f. Turn OFF battery (master) switch.

Do not fly until deficiency is corrected.

ELECTRICAL FIRE

Circuit breakers provide automatic disconnection in the event of a short circuit. If an electrical fire occurs turn OFF battery and generator (alternator), LAND as soon as possible and investigate. NOTE: The helicopter is capable of sustaining flight with battery and generator switches off. After landing do not fly until deficiency has been corrected.

SMOKE AND FUME ELIMINATION

REDUCE airspeed to 25 knots, OPEN cabin door until smoke is dissipated, LAND as soon as possible and investigate. After landing do not fly until deficiency is corrected.

SAFETY OF FLIGHT AIRCRAFT DOORS

In the event a door comes open in flight an attempt should be made to close it immediately. If it cannot be closed in flight execute a power-on approach to the nearest available clear area and try to securely close and latch the door. If you are unable to latch it closed call for maintenance assistance. Do not continue flying with a door that will not stay closed.

POWER TRAIN FAILURE

Any loss of power to drive the rotor system while the engine continues to operate normally.

Indications: Surge of engine tachometer needle past rotor, with subsequent rotor decay.

Cause: Idler pulley bearing failure, actuator failure (TH-55A); planetary gear failure, clutch failure (OH-23D).

Recovery: Same as engine failure with exception to engine RPM. Attempt to rejoin the engine and rotor tachometer needles while collective pitch is in the full down position, increase throttle when needles are joined. If the engine tachometer needle goes past the rotor tachometer needle, roll throttle off and continue to autorotate the aircraft to the ground.

Generally, traffic at night will be controlled by radio from the control supervisor; and you will be required to have a thorough knowledge of all light signals. These light signals will be covered on the last page of this section, and you will receive a thorough briefing prior to night flying.
Tune the radio to the stagefield frequency after departing the heliport traffic and well in advance of entering stagefield traffic.
Aircraft, when turning onto 45-degree entry leg, will turn on landing light, and call the stagefield control as follows: "Pinto 2765 entry." Control will acknowledge and issue instructions.
When you are well established on the downwind leg, turn off the landing light.
Airspeeds in the traffic pattern will conform to day operation airspeeds.
Anytime you are in the traffic pattern, be careful not to overtake another aircraft. Look for the white tail light.

CAUTION: If your engine should fail, enter autorotation, turn on the landing light, and proceed into the wind.

Solo aircraft, when turning base leg, will call stagefield control for the desired lane as follows: "(Call sign), base Two." Stagefield control will acknowledge and issue instructions, and you should acknowledge control's instruction.
Approaches will be made to the downwind light. Students will make no approaches solo without the landing light, except in an emergency (electrical failure).
Do not turn the landing light on until just before initiating the approach.
Exercise caution in maintaining alignment with the lane on final and during the approach.
Go-around procedure will be as follows: The pilot will establish a normal climb, then turn on the landing light and call, "Control, (Call sign), go-around lane three." Control will acknowledge. The pilot will climb straight ahead to traffic altitude and then to a point where the normal cross-wind leg is. At this point Control will advise him to either remain in closed traffic or leave traffic and re-enter. He will then acknowledge the call, turn off his landing light and continue as advised.

During take-off, navigation lights will be checked as follows: The Control Supervisor, in clearing aircraft for take-off, will visually check all lights on the aircraft. This will be done when aircraft are making clearing turns. All pilots are required to report any burned out lights noted on other aircraft. Aircraft with a burned out light will turn on landing light and contact Control for instructions to proceed to the parking area.

All take-offs will be rigidly controlled by radio from the stagefield control. Only one aircraft will be cleared for take-off at a time in the traffic pattern.

To insure lateral spacing of aircraft for take-offs in different traffic patterns, at least one lane clearance will be maintained.

Aircraft at the take-off panel will make a clearing turn. Control will clear aircraft for take-off. NOTE♦ Aircraft in the same pattern will not be cleared for take-off until other aircraft on take-off has turned cross-wind.

Clearance to proceed to the parking area will be received from Control as follows: "(Call sign) lane four clearance to parking area." Control will issue instructions. Clearance to cross lanes must be received from Control.

Clearance to proceed from parking area will be received from Control as follows: "(Call sign) parking area clearance to east traffic." Control will issue instructions.

Aircraft that has radio failure (either transmitter or receiver) will proceed as follows: Aircraft at the take-off panel will flash landing light and turn towards the tower for signal light clearance to proceed to the parking area. Aircraft in traffic will continue and after completing the approach proceed as outlined above. Aircraft not established in traffic will return to the heliport.

Aircraft that has complete electrical failure will proceed as follows: Aircraft at the take-off panel will proceed, using extreme caution, to the parking area. If in traffic, break out and return to the heliport. The pilot will then notify the tower operator of his arrival and have the message relayed to the stagefield control.

Upon completion of an autorotation (dual only), the pilot will clear the lane and move to a position parallel to the take-off position of an adjacent lane. Control will issue instructions.

Aircraft departing the stagefield and entering heliport traffic will break the traffic 45 degrees to cross-wind leg and the pilot will call stagefield control as follows: "(Call sign) departing traffic to return heliport." Control will acknowledge.

After clearing stagefield traffic, tune the receiver to the heliport frequency and call the heliport, using the aircraft's number, to establish contact and request landing instructions.
When crossing the I.P. for landing at the heliport, the landing light will be turned on and will remain on until the aircraft is parked. The radio call will be made over the I.P.
After completing the approach, leave the landing light on and hover, using extreme caution, to the aircraft's parking spot. Be sure to leave the navigation lights on until the main rotor is secured.

Things to Remember:

Adapt your eyes to night vision and discipline yourself to keep them adapted.
Keep your instrument and cockpit lights turned down to a minimum.
Learn to use the techniques that give your eyes a break.

Light Signals:

Color and Type	On the Ground	In Flight
STEADY GREEN	Clear for Take-off.	Cleared to Land.
FLASHING GREEN	Cleared to Taxi.	Return for Landing.
STEADY RED	Stop	Give way to other A/C. Continue circling.
FLASHING RED	Taxi clear of landing area in use.	Airport unsafe. Do not land.
FLASHING WHITE	Return to starting point.	Not used.
ALTERNATING RED AND GREEN	General Warning Signal.	Exercise extreme caution.

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SECTION X

STUDENT INFORMATION

FLYING DUTY SYMBOLS

Symbols to indicate performance of flying duties:

1. Pilot Duty
   (a) P - First Pilot
   (b) IP - Instructor Pilot
   (c) SP - Student Pilot
   (d) CP - Co-Pilot
   (e) Z - Buddy Ride
2. Other Duty
   (a) CE - Aircraft Mechanic
   (b) M - Flight Surgeon

FLIGHT CONDITION SYMBOLS

(a) N - Night
(b) H - Hood
(c) W - Weather
(d) NW - Night Weather

MISSION SYMBOLS

(a) TIC - Primary I Training (Student)
(b) T2C - Primary II Training (Student)
(c) T3N - Navigation Training
(d) T4C - Instructor Training
(e) S4 - Test Flight
(f) S5 - Admin Flight Litter
(g) T5 - Military Flight Instructor Training

PARKING PROCEDURE

All helicopters will be parked with the wind from the right rear, approximately 135 degrees to the right from the nose of the aircraft. If the winds are high, land the helicopter into the wind, then "TAXI" the helicopter around, terminating with the wind from the right rear. To take off with a strong wind, "TAXI" the helicopter around into the wind prior to take-off.

HIGH WIND PROCEDURE

OH-23D ONLY

During high winds, the pilot may expedite the stopping of main rotor by grasping the five inch drive tube at either end and exerting equal pressure with both hands. CAUTION: Do not push or pull the drive tube. Beware of catching cloth on rotating elements and avoid scratching the drive tube with rings. Remove gloves before attempting this procedure.

ALLOWABLE FLYING TIME

OH-23D

Two hours and fifteen minutes (2:15) from engine start time to termination of flight.

TH-55A

(With 30 Gallon Tank)

Two hours (2) from engine start time to termination of flight.

(With 25 Gallon Tank)

One hour and forty-five minutes (1:45) from engine start time to termination of flight.

CAUTION: ALL ENGINE OPERATING TIME MUST BE INCLUDED IN TOTAL ALLOWABLE FLYING TIME.

STAGEFIELD OPERATIONS

Flags and Lights at Stagefields and Heliports:

(a) GREEN - Dual and solo
(b) YELLOW - Dual only
(c) WHITE - Return to parking area
(d) RED - Flying canceled. Return to stagefield or heliport.

DENSITY ALTITUDE COMPUTATION

(Approximate)

Density altitude = pressure altitude +120 K (actual temperature - standard temperature).

Pressure altitude can be read directly from the altimeter by setting 29.92 in the window; 120 is a constant. Actual temperature can be read from the outside air temperature gauge. Standard temperature is 15 degrees C minus 2 degrees C for every 1,000 feet above sea level.

Sample Problem:

Field Elevation = 1,000 feet
Pressure altitude = 2,000 feet
Actual temperature = 25 degrees C
Std. Temp = 11 degrees (Std. sea level 15 degrees
-2 degrees for every 1,000 feet)
Density altitude = 2,000 + 120 K
(25 degrees - 11 degrees)
= 2,000 + 120 x 14)
= 3,680 Feet

PHONETIC ALPHABET

A - Alfa.-
B - Bravo-...
C - Charlie-.-.
D - Delta-..
E - Echo .
F - Foxtrot..-.
G - Golf--.
H - Hotel....
I - India..
J - Juliet.---
K - Kilo-.- (Pronounced Kee-Low)
L - Lima.-.. (Pronounced Lee-Mah)
M - Mike--
N - November-.
O - Oscar---
P - Papa.--.
Q - Quebec--.- (Pronounced Kay-Beck)
R - Romeo.-.
S - Sierra...
T - Tango-
U - Uniform..-
V - Victor...-
W - Whiskey.--
X - X-Ray-..-
Y - Yankee-.--
Z - Zulu--..

NUMERALS
0 - zero
1 - wun
2 - too
3 - three
4 - fo-wer
5 - five
6 - six
7 - seven
8 - ate
9 - ni-ner