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HEADQUARTERS
UNITED STATES ARMY PRIMARY HELICOPTER SCHOOL
FORT WOLTERS, TEXAS

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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.

In order to provide continuity of instruction and to give you the necessary background for beginning each successive phase 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.

E. P. FLEMING, JR.
Colonel, Arty
Commandant

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SECTION I

INTRODUCTION TO PRIMARY FLIGHT TRAINING

This manual is designed as a guide 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 judgement, 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 Officer 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 "Training Directives."

USAPHS Training Directives 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 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 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 pre-flight check. Remember, any item on a pre-flight 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.

Standardization Rides:

Purpose: The Military Flight Evaluation Division of the USAPHS is responsible for evaluating the 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.

Method: The Military Flight Evaluation Division administers standardization rides to evaluate flying proficiency, quality of instruction, and standardization of maneuvers. Pre-solo stage check rides will normally be given by your own instructor. You will be given a standardization ride during Primary I and Primary II stages, administered by a Military Flight Evaluation Division standardization pilot. In Primary I stage the standardization flights begin on Wednesday of the fifth week and continue through the eighth week. In Primary II stage standardization flights begin on Wednesday of the tenth week and continue through the fourteenth week.

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 Stage Field Control or supervisory personnel. Do not transmit any comments as to the instructions received. Give them to your instructor after the flight.

Pre-Flight Inspections and Checklists:

Performing a thorough and complete pre-flight and an accurate and complete cockpit check is one of the most important parts of your Primary Helicopter Training. The pre-flight 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 pre-flight and cockpit procedures.

Use of Checklist:

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

Special Instructions:

During your training at this school, you may be assigned to fly the OH-13, 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 for those items that are commonly used by aircraft type.

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SECTION II

FUNDAMENTALS OF FLIGHT

All 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 greatly 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, so 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.

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 both 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.

The Throttle:

The throttle is located at the forward end of the collective pitch and regulates the amount of fuel air mixture going to the engine.

Anti-Torque Pedals:

The pedals are used to maintain the heading and counteract the effects of torque. Anti-torque control in the single rotor helicopter is accomplished by means of a variable pitch rotor, called a tail rotor. By increasing or decreasing the pitch of the anti-torque rotor, it is possible to counteract the torque forces created by applying power to the main rotor blades. Notice during cruising flight that if you hold the pedals stabilized in a neutral position and increase power, the aircraft will turn back to the right. The amount of torque varies with the power applied, so the amount of thrust developed by the tail rotor must be varied by the pilot as the power is increased or decreased. This is done by connecting the anti-torque pedals to a pitch changing device on the tail rotor. As power is applied, it is necessary to add left pedal to increase the pitch on the tail rotor blades to keep the helicopter from turning or yawing to the right. As power is decreased, you add right pedal to decrease the pitch on the tail rotor blades to keep the helicopter from turning or yawing to the left.

You must remember that the anti-torque pedals are used only to counteract torque and to keep the longitudinal axis (heading) of the helicopter properly aligned. It is very important to properly coordinate the anti-torque pedals with power changes during airwork to keep the fuselage streamlined with the direction of flight.

Using the Controls:

Now that you know where the controls are, you must learn how to use them properly. Rough and erratic usage of all or any one of the controls will cause the aircraft to react accordingly, so it is important that you be able to apply the pressures smoothly and evenly.

How to Use the Cyclic:

Grasp the cyclic grip lightly, with the right forearm resting on the leg. It is important that your arm and hand be relaxed so that you feel any pressure that may be exerted on the cyclic. It is the pressure exerted on the cyclic that causes the aircraft to move horizontally.

How to Use the Collective Pitch:

Grasp the collective pitch by the throttle grip and the same type pressure should be used on the collective pitch as the cyclic stick. All pitch movements should be slow and smooth so that the throttle and pedals may be coordinated with the power changes.

To gain altitude, apply pressure upward on the collective pitch. To lose altitude, apply downward pressure on the collective pitch. Notice as you reduce collective pitch, the manifold pressure goes down and you start to lose altitude. As you increase collective pitch, the manifold pressure goes up and you start to gain altitude. The manifold pressure guage is your index of power.

How to Use the Throttle:

Grasp the throttle lightly. Keep your arm relaxed and your wrist straight in a comfortable position. All movement must be very slow and smooth, usually only a slight wrist movement is needed to make normal throttle changes. When large movement of the throttle is necessary, the hand should be re-positioned to keep your wrist in a comfortable position.

Throttle and Collective Pitch Coordination:

The throttle is coordinated with the collective pitch to maintain a constant operating RPM. Although most helicopters have a certain amount of designed synchronization between collective pitch and throttle controls, the pilot is primarily responsible for throttle control. For the purpose of expediting development of pilot technique, collective pitch and throttle control may be considered to be effected as follows:

(1) Coordination of throttle and collective pitch is used to obtain desired manifold pressure and RPM. The throttle adjusts RPM and collective pitch adjusts manifold pressure; however, correction of either control changes both RPM and manifold pressure. These controls are normally very sensitive, and corrections should be small and smoothly performed to prevent overcontrolling.

(2) Raising the collective pitch control increases manifold pressure and, normally, decreases RPM. Lowering collective pitch decreases manifold pressure and, normally, increases RPM. Increased throttle gives higher RPM and manifold pressure; decreased throttle give the opposite effect. To hold a constant power setting, coordination of pitch and throttle corrections should be simultaneous.

How to Use the Anti-Torque Pedals:

To use the pedals correctly, apply pressure smoothly and evenly by pressing with the ball of one foot. When one pedal is pushed forward, the other will come back an equal distance. Make large pressure changes by applying the pressure with the balls of your feet and let your heels slide along the cabin floor. Remember, let the balls of your feet rest very lightly and comfortably on the pedals so that you can feel the pressures.

Turbulence and Wind Conditions:

Turbulence and gusts may call for minor corrections. Therefore, when the air is rough, the flight attitudes may change. Don't try to fight the controls to prevent this from occuring. Just make smooth adjustments in the flight attitudes as needed.

Whenever any object frees itself from ground friction, that is, when it no longer has any connection with the ground, it can only be affected by the air mass with which it is surrounded. This means that it is free to move, and must move, in the direction the air mass is moving, and at the same velocity. As soon as the aircraft becomes airborne, it is free from ground friction. It, therefore, is affected by the air mass in which it is flying. In your flying training, you will notice that the aircraft does not always follow in the same direction the nose is pointed. You will probably, at one time or another, be flying parallel with a road. The longitudinal axis of the aircraft is lined up perfectly with the road and you are flying a straight-and-level course. Suddenly you realize the aircraft is getting closer to the road or has actually crossed it, without any turn having been made. This would indicate to you that the air in which you were flying was moving in a direction that caused it to cross the road at some angle. Of course, whenever air moves, we feel the pressure of its movement when we are standing on the ground, and we call this movement of the air the wind. Since the aircraft is flying in this certain body of air, it tends to move along with the air in the same direction and at the same velocity.

Suppose you were flying along straight-and-level and the wind was blowing 30 mph from your left and precisely 90° to the direction the aircraft was pointed. At the end of one hour, the body of air in which you were flying would have moved 30 miles to your right. Since the aircraft is in this body of air, and moving right along with it, you and the aircraft would also have drifted 30 miles to your right in one hour. Of course, in relation to the air, you only moved forward; but, in relation to the ground, you have moved forward and 30 miles sideways. This effect is known as drift, and must be compensated for in order to cause the aircraft to pass over a desired track, or course, on the ground.

The proper way to correct for drift when you are flying straight-and-level and wish to follow a selected ground track is to turn the aircraft slightly into the wind. This may require only a turn of a few degrees. When you seem to have the drifting effect stopped, level the helicopter. Now the aircraft is flying straight-and-level again, but is pointed into the wind slightly. This causes the aircraft to fly into the wind at the same rate that the wind is attempting to move the aircraft sideways. Since the drifting effect has now been neutralized, the aircraft flies a straight-and-desired ground track. This effect is known as "crabbing" because the aircraft appears to be flying slightly sideways in relation to the ground.

There will be times when you will want to correct for drift while in a turn. As you know, the wind in relation to the ground will be acting on the aircraft from constantly changing directions 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 rate of turn is governed by the angle of bank and the airspeed of the aircraft. Assuming a constant airspeed, 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° over the ground, because the air track and ground track are identical.

All you have to do is approach a road from a 90° 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° 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° 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° in the opposite direction, make exactly the same size semi-circle and be back to the road just as the turn is completed. 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.

AIRSPEEDS

Cruise	50 Kts
Climb & Descend	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	2300 RPM
Autorotations (Entry)	3200 RPM
Simulated Forced Landings and Autorotations	2300 RPM
Descents Below 500 Feet	3200 RPM
Rotor RPM Operating Range (Green Area)	322 - 370 RPM

POWER SETTINGS
(Manifold Pressure)

(CAUTION: Do not exceed 27.5 inches - OH-13H, 28.8 inches OH-13E & G)

Hover	Power as necessary to hover at an altitude of 3 feet into the direction of take-off using 3200 RPM.
Normal Take-Off	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.

OPERATING INSTRUCTIONS
OH-23 D and G

Airspeeds

Cruise	50 Kts
Climb & Descend	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, which ever occurs first.

OPERATING INSTRUCTIONS
TH-55

AIRSPEEDS

Cruise	50 Kts
Climb and Descend	40 Kts
High Cruise	60 Kts
Autorotation	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	2400 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.

SECTION III

PRE-SOLO MANEUVERS

STRAIGHT AND LEVEL FLIGHT

Purpose:

Straight-and-level flight is flight in which a constant altitude, attitude and direction are maintained. In the Pre-solo stage of training, it demonstrates one of the basic fundamentals of flight. In later training, it will be the basis for the precision contact flying necessary to become an Army Aviator.

Preparatory:

Before practicing straight-and-level flight, you must understand thoroughly the effect and use of controls, be comfortably seated and completely relaxed.

Attaining level flight is a matter of fixing the relationship between reference points on the helicopter and the horizon. These reference points will be used in varying degrees on all maneuvers. Your instructor will establish straight-and-level flight and show you the visual reference points around the cockpit so that regardless of where you look, you can accurately judge the attitude of the helicopter.

Technique:

The airspeed for straight-and-level flight is usually the normal cruising airspeed. Constant attitude of flight is accomplished by selecting a point on the bubble, or the relative position of the console, and keeping it in a fixed position with the horizon. You determine your airspeed by the attitude of the helicopter, using the airspeed indicator as a cross-check to maintain cruising attitude. Any noticeable deviation from this attitude means the helicopter is not in a cruise attitude, and you will gain or lose airspeed. Fore or aft cyclic pressure is used to correct and to re-establish the relationship between your cockpit reference points and the horizon. You maintain attitude in level flight by visually checking the relationship of objects in the cockpit with the horizon. To maintain a level and coordinated condition, adjust the cyclic laterally and apply pedals to trim.

You achieve heading control in flight by selecting a point on the horizon directly to the front. Left or right pedal pressure is used to control yaw and trim. Pedals usually require very little adjusting in straight-and-level flight, but must always be used as power is increased or decreased to compensate for the variance of torque effect and avoid any yawing or turning of the nose.

Things to Remember:

Time spent looking in the cockpit is harmful to visual flying, especially in the early stages of your flight training. Spend as little time as possible checking your engine instruments, carburetor air temperature, etc., but don't forget them.

Let your eyes rove all around the horizon and look for other aircraft that might be flying in your area while you check your visual references and orientation to the home field.

LEVEL TURNS

Purpose:

A turn is a maneuver used to change the heading of the helicopter. Since turns are incorporated into almost all other maneuvers, it is important that you be able to perform them well.

There are three types of turns—level, climbing, and descending—with variations in each of these to include gentle (15°), medium (30°), and steep-banked (45°) turns.

Preparatory:

This maneuver is executed from level flight. The conditions of flight are the same as for straight-and-level flight.

Before beginning any turn, look in the direction of the turn to clear above, below, and at your flight level. You do this to make sure that the area is clear of other aircraft that may interfere with safely executing the turn. All practice turns in flight unless otherwise specified are 90° turns, so while you look to clear the area, also pick out some object to use as a guide point for completion of your turn.

Technique:

When the area has been cleared, apply a slight sideward pressure on the cyclic in the direction you wish to turn; this is the only control movement necessary to start the turn. Do not use your pedals to assist the turn. The further you move the cyclic, the more the bank and the faster the rate of turn. You should practice using a slight pressure on the cyclic, and roll into your turns slowly to aid you in learning to feel the pressures properly. Approximately fifteen degrees of bank is most commonly used.

It is important to maintain a constant altitude and airspeed during the turn. This can best be done by holding a constant relationship between cockpit reference points and the horizon. If these references are kept in the same relative position to the horizon throughout the turn, you will have a relatively constant altitude and airspeed. Cross-check by occasionally glancing at the altimeter and airspeed indicator and continue to clear the area while turning. Throughout the turn, the degree of bank should be held constant with the cyclic, just as it was to keep the aircraft level in straight-and-level flight.

Your recovery from a turn is the same as the entry except the pressure you use on the cyclic is in the opposite direction. Since the helicopter will continue to turn as long as there is any bank, start the roll-out before reaching your desired heading. This will allow the helicopter to turn during the time it takes to roll from a banked attitude to a level attitude. As the helicopter becomes level, you should be aligned with your previously selected guide point and in straight-and-level flight.

Things to Remember:

Your posture while seated in the helicopter is very important in all maneuvers, especially in turns. Don't lean from side to side during turns. Don't lean away from the turn or attempt to keep your body vertical with the horizon; ride with the turn.

NORMAL CLIMB

Purpose:

A climb is a maneuver to gain altitude at a controlled rate and attitude. You will practice normal climbs in the Pre-Solo stage of your training to continue increasing proficiency of coordination and to develop your technique (control touch) so that you will make smooth and accurate changes of attitude and power while accomplishing the maneuver.

Preparatory:

In the early portion of the Pre-solo stage, you will usually enter a normal climb from straight-and-level flight.

Technique:

To establish a normal climb, apply (1) a slight aft pressure on the cyclic to raise the nose to a climb attitude; (2) upward pressure on the collective pitch to establish a climb power setting using RPM shown in appropriate aircraft operating instructions; simultaneously apply a slight pressure on the left pedal to counteract the increased torque effect.

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 manifold pressure to normal cruise setting and apply pressure on the left pedal to counteract increased torque. 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° 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° 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.

To establish a descending turn, use the same procedure as to establish a normal descent, and coordinate lateral pressure on the cyclic so the bank and the descent attitude are attained together. If perfectly established, the descent and bank attitudes will be attained at the same time. Since this does not always occur, hold whichever one that is attained first and then effect the other.

Recover by rolling out of the bank and establishing cruising flight so as 90° of turn is completed, you are flying straight-and-level.

Things to Remember:

You should start to develop a "feel" for applying the proper amount of pedal as power is changed because when a climb or descent and a turn are started simultaneously, you cannot readily detect yaw of the nose since the aircraft is already starting to turn as the power is changed.

HOVERING

Purpose:

This maneuver requires a high degree of concentration and coordination. When hovering, keep the helicopter over a spot by using the cyclic control stick, and govern altitude by the use of collective pitch. A constant heading is kept by using the anti-torque pedals. Only by the proper coordination of all controls can you achieve successful hovering flight.

Preparatory:

All control corrections should be pressure movements rather than abrupt movements. This is necessary to prevent overcontrolling, which is the most common fault of the new helicopter pilot when learning to hover.

In hovering, as in straight-and-level flight, the attitude of the helicopter is again the governing factor which determines movement over the ground. In the early stages of your training, your instructor will head the helicopter into the wind and trim the cyclic while maintaining approximately three feet of altitude. Check the visual references in the cockpit relative to the horizon; this attitude will keep the helicopter hovering over a spot. Direct your attention well out in front (about 50 feet) and do not stare directly at the ground. When you are looking in too close, you will tend to over-control because of attempting to correct every little movement. Your primary concern is to keep the helicopter under control.

Technique:

Hovering altitude is maintained by use of the collective pitch, coordinated with the throttle to maintain a constant RPM. The amount of collective pitch needed to maintain three feet will vary under different conditions of wind, air density, and gross weight. When a steady wind is blowing, it is not necessary to manipulate the collective pitch a great deal to hold three feet of altitude. Notice how the ground looks while you are hovering at three feet. When the helicopter starts to settle, you will notice that objects on the ground become more level with your line of sight, and when starting to climb, your line of sight becomes steeper. When you notice the helicopter start to settle, apply a light upward pressure on the collective pitch, and if necessary, squeeze on throttle to maintain RPM and add left pedal pressure to counteract for increased torque effect. When the helicopter starts to climb, apply a slight downward pressure on the collective pitch and if necessary, squeeze off throttle to maintain RPM and relax some left pedal pressure to remove some of your torque correction.

The cyclic is used to maintain your fixed position over the ground. The helicopter will not move if it is in a **proper attitude** for the load distribution and the existing wind. Notice the relationship of the top of the console and other cockpit reference points to the horizon. As long as the reference points remain in this relation to the horizon, the helicopter will be in a level attitude and will not move over the ground unless there is a variation in wind. In order to hover, you must hold this attitude with the cyclic.

If the level attitude changes to a nose-low attitude, the helicopter will start to move forward. Notice the relation of the console to the horizon in the nose-low attitude. To stop the forward movement, bring the nose back to a level attitude by applying a slight aft pressure on the cyclic. When the nose reaches the level attitude, the aft pressure on the cyclic is relaxed and the helicopter will drift to a stop.

If the level attitude changes to a right-side-low attitude, to stop the sideward movement, apply a slight left pressure on the cyclic. When the helicopter returns to the level attitude, the left pressure is relaxed and the helicopter will drift to a stop.

The same technique is used to stop the movement when left-side-low or nose-high.

Notice that there is a lag between the time of a nose-low attitude and the beginning of forward movement. In order to hover without forward movement, it is necessary to recognize a nose-low attitude and correct for it before starting to move forward. When the helicopter starts into a nose-low attitude, raise the nose to the level attitude before it starts to move. In this way, by detecting changes from the level attitude, you can maintain your position. The same technique is used to prevent sideward or rearward movement.

Things to Remember:

The coordination of all controls when hovering cannot be over-emphasized. Any change on one control almost always requires a coordinated correction on one or more of the other controls. Hovering can be accomplished with precision only when corrections are small, smooth and coordinated.

HOVERING TURNS

Preparatory:

Hover three feet above the ground with the aircraft headed generally into the wind. Maintain normal operation RPM.

Before starting the turn, pick out two objects that are in line 90° to your right or left. When you complete the 90° turn, you should be lined up with these objects.

Technique:

To start the turn, add a little pedal in the direction you wish to turn—just enough pressure to start the nose slowly turning. Use throttle to maintain RPM.

While turning, keep the cyclic into the wind as required to maintain the same position over the ground.

As you approach the completion of the turn, use the opposite pedal necessary to stop at a point in line with the two objects selected before starting the turn. Maintain hovering altitude with pitch and RPM with throttle.

Things to Remember:

Adding right pedal will decrease the pitch on your tail rotor and you will need less power to keep proper RPM. When adding right pedal, simultaneously squeeze off a little throttle to maintain RPM.

Adding left pedal increases the pitch on the tail rotor and you will need more power to keep proper RPM. When adding left pedal, simultaneously squeeze on a little throttle to maintain RPM.

TAKE-OFF TO A HOVER

Preparatory:

Before take-off to a hover, check carefully for any nearby obstructions forward, rearward, and to the sides.

It is important to keep a constant heading when breaking ground. Lining up with an object that is near the helicopter and with one that is farther away will help you. Direct your vision about 50 feet to the front.

Technique:

Apply a smooth, slow, upward pressure on the collective pitch 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 apply right pedal 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.

Things to Remember:

Make a 90° clearing turn in the direction of flight prior to hovering sidewards or backwards.

TAXIING

Purpose:

Taxiing is the intentional movement of a helicopter under its own power on the ground. It is used to move the helicopter to a point from which hovering flight can be accomplished safely. The helicopter should be taxied slowly enough to permit stopping immediately if an emergency arises.

Preparatory:

Place the helicopter in a stationary position, maintaining proper RPM with the collective full down.

Technique:

Move the cyclic slightly forward of the neutral position and apply a gradual upward pressure on the collective pitch to start moving forward along the ground. Use pedals to maintain heading and cyclic to maintain ground track. Collective pitch controls starting, stopping, and rate of speed while taxiing. The higher the collective pitch, the faster you go. Do not taxi faster than the speed of a normal walk.

If you have a cross-wind, hold the cyclic into the wind to maintain ground track. If the helicopter should start to tip, lower the collective pitch immediately and make the necessary cyclic corrections. Be sure to maintain proper RPM until you come to a complete stop.

Things to Remember:

Most students learn to handle the collective pitch and pedals fairly well but often apply excessive forward cyclic. Remember, only a slight amount of forward cyclic is required.

RECTANGULAR COURSE

Purpose:

The rectangular course is a maneuver in which the ground track of the helicopter describes a rectangle on the ground, equidistant on all sides from a selected rectangular area on the ground.

Flying a rectangular course will give you an opportunity to learn how to fly a practical ground track. This maneuver teaches the establishment of "crabbing" angles and ground tracks necessary on all legs of the traffic pattern. It provides experience in the practical application of turns.

The most important objective is to teach you division of attention between flight path, ground objects, and the handling of the helicopter.

Preparatory:

Select a field or a group of fields having a rectangular or square border outline. This field should be well away from any traffic at the heliport or stage fields, and should be of sufficient size to simulate one of these. When you have selected the rectangle, check the wind direction and visualize a traffic pattern. This pattern should be flown to the outside of the rectangle. The field boundaries should be of sufficient distance to be observed at a 30° to 45° angle.

Technique:

When the correct distance from the field is determined, fly parallel to one boundary until the corner is approached. A turn should be started at this point and planned so a ground 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 ACROSS A ROAD

Purpose:

This is a meneuver in which the ground track of the helicopter describes a half circle on both the upwind and downwind sides of a road 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° 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.

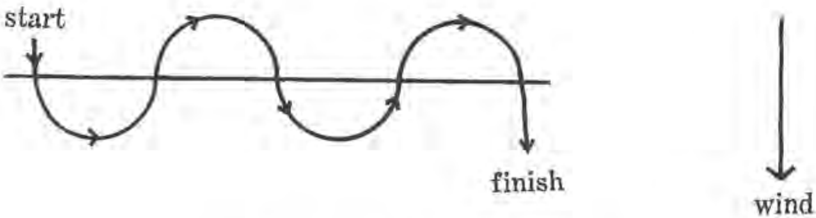
Technique:

At cruising airspeed and at an altitude of 500′ above the ground, position the helicopter to approach the road going downwind 90° 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 road upwind, you should be completing a 180° turn of constant radius. As the aircraft is over the road, roll from one bank to the next and prepare to execute another 180° turn on the upwind side of the road 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 road.

Things to Remember:

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



SIMULATED FORCED LANDINGS

Purpose:

Simulated forced landings will prepare you to act promptly and efficiently in an emergency. They will develop accuracy, judgement, 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 areas. 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 closes 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. Your instructor will open 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.

There are three methods used to terminate simulated forced landings. Your instructor will tell you what method of terminating will be used.

1. A simulated forced landing may be completed by touching down on a designated sod touchdown area. At about 100 feet check rotor RPM, if in proper range, close the throttle. Prior to touchdown make another check of rotor RPM. The technique is the same as the technique used in autorotations at the stagefields. However, on the soft or loose sod areas, the collective must be held up to keep the helicopter light during the ground run.

2. A simulated forced landing may be completed by making a power recovery. Your instructor will make a power recovery in sufficent time to prevent flight below 100 feet AGL. 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 over-rev. 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 join-

ed, continue adding throttle and collective to the normal climb power setting. Adjust attitude to normal climb.

3. A simulated forced landing may be terminated with power. This maneuver will be executed by decelerating the helicopter at the normal altitude (35 to 50 feet, OH-13 and OH-23; 25 feet, TH-55) and joining the needles in the apex of the deceleration. The throttle and collective should be coordinated to join the needles at hover engine RPM. A controlled, powered descent will be made from this point to a three foot hover. This maneuver will be performed only over designated touchdown areas.

4. A power recovery from a forced landing must be completed by 100' AGL.

Things to Remember:

Plan every simulated forced landing so that an actual landing could be made. A combination variance of airspeed and flight path will allow you to maneuver into the landing area without extreme variance of either; this usually affords better and easier control of the landing.

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 air speeds produce a longer glide. Lower air speeds 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.

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. NOTE: <u>TH-55 normal take-off, should not exceed 26.2" MP and 2900 RPM below 300 feet AGL. This is a safety precaution, not an engine limitation. Due to high pitch angle produced in the rotor system at power settings above 26.2" manifold pressure, recovery from engine failure below 300' is extremely difficult.</u>

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 stage fields.

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° Entry Leg:

Enter the traffic pattern on a ground track of 45° 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 ft. -- 50 knots, 400 ft. -- 45 knots, 300 ft. -- 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 stage field. 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 take-off is the first leg of the traffic pattern. Climb at 40 knots straight ahead. If a cross-wind exists, fly in a slip the first 50 feet, then a crab the remainder of the leg. At 300 feet, make a 90° ground track climbing turn to the crosswind leg. Fly the crosswind leg with the ground track perpendicular to the stage field.

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 crosswind leg make a 45° ground track climbing turn away from the stagefield and continue to climb to 500 feet above the terrain. Upon reaching 500 feet carefully clear for other traffic, then a turn in any direction away from the stagefield traffic 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' 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′ 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° approach angle and a constant apparent rate of closure. The approach is terminated at a 3′ 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′ 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 15 knots, you will increase the airspeed 5 knots. 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.

The normal approach is made at an angle of descent of 12°. To determine this 12° angle of descent, you use a "sight picture" with the helicopter in a 40 knot (normal wind condition) attitude and the approach panel in the sight picture position on the bubble of the helicopter. This sight picture will be demonstrated by your instructor by letting you observe the panel relative to your visual reference points in the cockpit. It will vary for different height people and you will learn what the sight picture is for you. The sight picture will not be accurate if the helicopter is not in the proper attitude and the result will be improper approach angles.

Technique:

Evaluation of existing winds will determine at what point the collective pitch should be lowered to intercept a 12° angle. When this point is reached, begin the normal approach by lowering the collective until you "feel" and observe the helicopter begin to descend. Visualize a straight line to the approach panel and keep the helicopter on this imaginary line using collective pitch. Notice the rate the panel appears to be moving toward you. This is called **apparent rate of closure.** The proper apparent rate of closure is that of a brisk walk. When the closure rate is correct, maintain this rate with cyclic. Forward cyclic to increase the rate or rearward cyclic to decrease the rate of closure. The proper apparent rate of closure may be reached at almost any point during the descent, dependent upon wind. In a strong wind, the rate may appear to be slow; if this occurs, continue holding the entry speed until the rate appears correct. In a light wind, the rate of closure will seem fast and immediate action is necessary to adjust this rate. The above technique will be used throughout the approach. Collective pitch to maintain a

12° angle of descent and cyclic to maintain apparent rate of closure. In the last portion of the approach, the helicopter may tend to descend below the proper angle. This is because translational lift is being lost due to a slower airspeed. At this time, additional collective pitch must be continually added to prevent an under-arc. Maintain heading with pedals and RPM with throttle. The termination should be in a level attitude, with no forward movement, three feet above and behind the selected panel.

Things to Remember:

Complete all adjustments to ground track, RPM, airspeed, and altitude on the final leg in sufficient time so all of your attention may be given to planning the entry as the panel nears the sight picture position.

HOVERING AUTOROTATION

Purpose:

The hovering autorotation is a practice maneuver designed to develop the reaction time and skill necessary to recover from an engine failure while hovering or during initial take-off.

Preparatory:

To practice hovering autorotations, hover at three feet into the wind. Stabilize the helicopter to prevent excessive movement over the ground. Maintain RPM and focus your vision to the front of the helicopter.

Technique:

To enter, close the throttle quickly to split the needles. As you close the throttle, apply right pedal to maintain heading; usually a slight amount of right cyclic will be necessary to keep from drifting. In any case, apply cyclic as required to insure a vertical descent. Leave the collective where it is on entry.

As the helicopter starts to settle, keep a level attitude with the cyclic and hold the heading with the pedals. The pitch is held constant. As the helicopter nears an altitude of approximately one foot above the ground, apply a positive upward movement on the collective pitch to slow your descent and cushion the landing. The timing on this pitch application has to be just right for a smooth 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 are 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 of 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, if appropriate for your type aircraft, 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 crosswind, 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.

DECELERATING TYPE AUTOROTATION

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

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

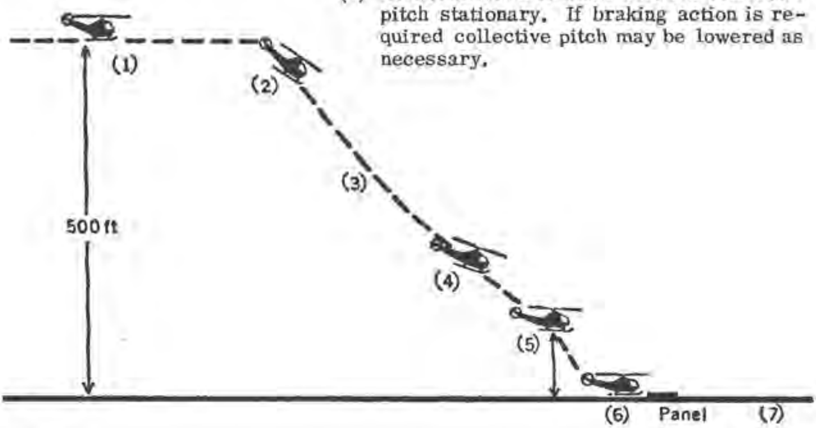
(3) 45-50 K attitude, call out "Rotor in the green." Pitch down.

(4) Over-ride 100 feet.

(5) At approximately 35-50' (OH-13 and OH-23) or 25' (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 the rate of closure, rate of descent and ground speed.

(6) At about 10-15' (OH-23), 5-10' (OH-13), or 3-5' (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.

(7) 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 the 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' check rotor RPM, close the throttle if a safe landing is assured. At approximately 35 to 50 feet (OH-13 and OH-23) or 25 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), 5-10' (OH-13) or 3 to 5 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 action is required, collective pitch maybe 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.

SECTION IV

PRIMARY 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 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.

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 or 27.5" OH-13H.) 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 and RPM 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. Over-controlling 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.

Preparatory:

The steep approach is commenced in the same way as the normal approach, 40 knots airspeed (normal wind) and 300 feet altitude.

Technique:

The angle you will use for this approach will be 20°. Just before you reach the steep approach sight picture, apply a smooth positive downward pressure on the collective pitch. A

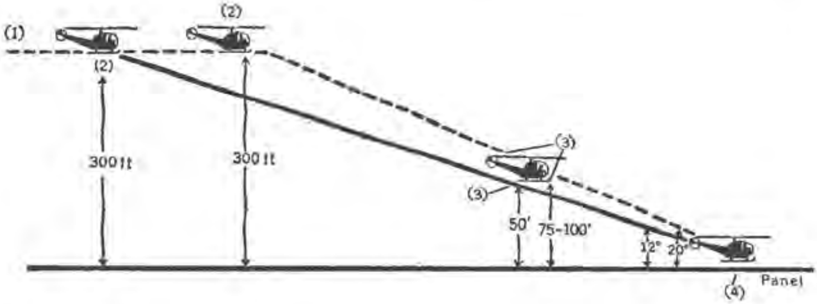
NORMAL AND STEEP APPROACH

(1) Fly final at 300′, 40K., on lane center line.

(2) Using a 12° or 20° angle sight picture, enter by lowering sufficient pitch to start a descent. Maintain RPM as pitch is lowered. Hold nose straight with lane using pedals. Note ground speed and apparent movement speed.
Begin constant deceleration to panel. Keeping the same apparent speed noted at entry. (Apparent brisk walk.)

(3) When sufficiently slow to cause loss of translational lift start applying pitch to maintain angle of descent. The last ⅓ of the approach is a decelerating hover to the panel. Squeeze on the throttle to maintain RPM adding sufficient pedal to keep the nose straight with the lane.

(4) Terminate 3′ above and 3′ behind the approach panel (a normal hover). Maintain RPM. Hold nose straight with pedals.



positive reduction of collective is required at the beginning of the approach to intercept a 20° descent angle.

The same principles apply in maintaining position on the proper angle of descent as in the normal approach.

Things to Remember:

If you over-arc **excessively** or let the angle of descent become **excessively** steep, either make a go-around or land beyond the original point of intended landing if clear.

An increase of airspeed on final should be made for winds in the same manner as outlined for a normal approach.

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:

Execute a clearing turn and land 3 feet behind the take-off panel. 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′ 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′ behind the panel with no ground run. The skids should be level as ground contact is made. A constant angle of 12° 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′ 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 accelerate to 40 knots and climb to an altitude of 25 feet. Maintain 25 feet and 40 knots and initiate the quick stop by making a smooth but positive reduction of collective pitch, followed closely by a rearward pressure on the cyclic. The desired technique is to reduce your forward speed smoothly but rapidly as the helicopter slowly starts to descend. 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 almost to a stop. 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 left pedal to maintain heading. Continue to apply pitch and throttle to stop the descent, level the helicopter and terminate at a stationary 3′ 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 50 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 maneuver.

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° autorotation is to fly the helicopter through 180° of turn in a coordinated manner while in autorotation.

Preparatory:

To practice 180° 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° 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, establish engine RPM as shown in appropriate aircraft operating instructions. Check rotor RPM and call out "Rotor in the green." Begin the turn by applying cyclic in direction you wish to turn and establish an approximate 45 to 50 knot attitude. 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 ft., 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 as the airspeed indicator is subject to some error in autorotative turns. 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.

SECTION V

ADVANCED MANEUVERS

The helicopter is well suited for operation into and out of small confined areas, pinnacles, and other unprepared landing areas. It is, therefore, essential that you be taught the fundamentals of such operations and develop your proficiency. Those maneuvers you have learned in Primary form the basis for execution of the Advanced maneuvers. In the Advanced stage, the majority of your attention will need to be directed to things outside of the cockpit.

When we mention operation in confined areas, we are immediately faced with the problem of a definition for confined area. A confined area, therefore, is any location where the movement of a helicopter is restricted by terrain features or by the presence of natural or man-made obstructions. Let us consider some general aspects of some of the factors affecting these operations.

Some general rules can be stated that apply to helicopter operation in any Advanced maneuver. The following are some of the most important ones to consider regardless of whether such areas are confined, slopes, or pinnacles.

Wind is an important factor that affects the flight and operation of all aircraft. Know the direction and approximate velocity of the wind at all times and plan your landings and take-offs with this wind condition in mind. This does not necessarily mean that your take-off and landing will always be made into the wind, but wind must be considered, and its velocity will determine proper avenues of approach and take-off.

A flight pattern similar to the rectangular pattern used at the stage fields will normally be used. The legs may be varied to fit the terrain. Should the terrain favor a different type of pattern, the deviation will be a matter of judgement. In certain instances, a teardrop pattern may be used.

When possible, plan your flight path within reach of forced landing areas in case of engine failure. It may be necessary to choose an approach which is cross-wind but over an open area instead of one directly into the wind but over heavily wooded or extremely rough terrain where a safe forced landing would be impossible. The initial phase of the approach may be made over an open area with a cross-wind, then execute a turn into the wind for the final portion of the approach.

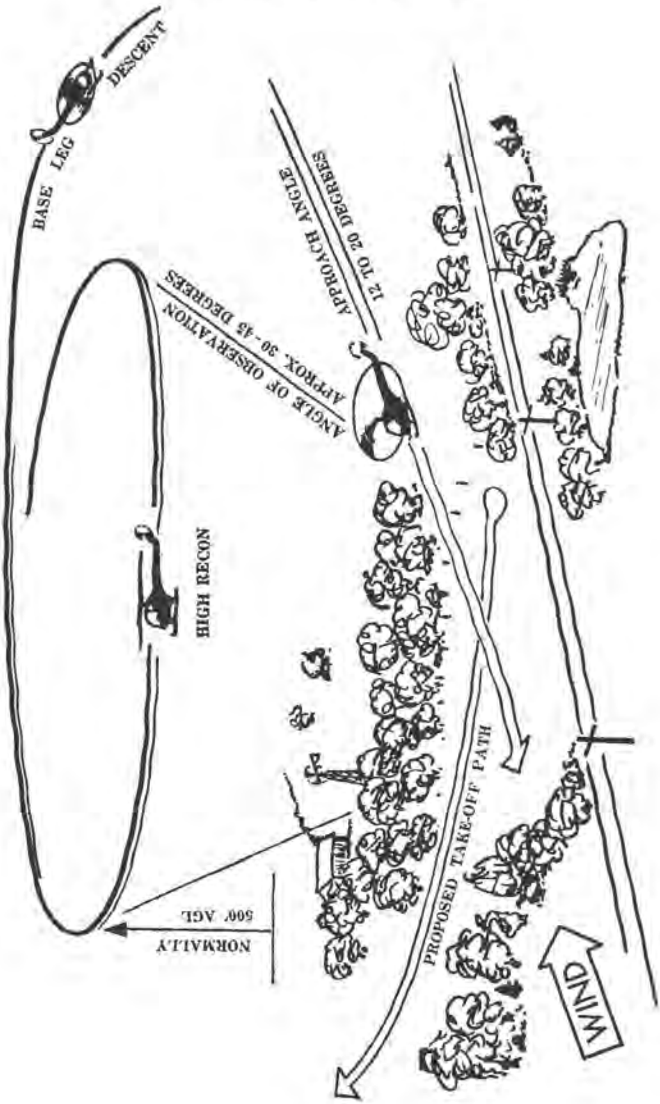
In all confined area operations, the approach angle should be that amount necessary to clear the barriers by 10 feet, both vertically and horizontally. This approach angle should never exceed a steep approach angle, nor should it be shallower than a normal approach angle.

Always make your landing to a specific point. The more confined the area, the more essential it is that the helicopter be landed with precision. This spot should be visible during the entire approach.

While flying a helicopter near obstructions, you must be continually conscious of the main rotor and tail rotor blades. Establish a safe angle of descent over barriers to insure sufficient clearance. After you come to a hover, avoid swinging the tail into obstructions. Never swing the tail to either side, unless absolutely necessary, until after you have made a ground reconnaissance. After landing and departure from the helicopter, be conscious of the tail rotor and keep a safe distance.

Keeping in mind the general precautions that will apply to any advanced maneuver, we will now consider the specific operation of a confined area, a pinnacle, and a slope landing. You must use your judgement on the execution of any of these maneuvers as it is impossible to establish any exact rules or regulations covering every circumstance.

CONFINED AREA OPERATION



HIGH RECONNAISSANCE:

Purpose:

The primary purpose of the high reconnaissance is to determine the suitability of the area for a landing.

Preparatory:

In a high reconnaissance, it is necessary to accomplish the following:

(1) Determine wind direction and velocity, if possible.

(2) Locate and determine the size of the barriers immediately around the area.

(3) Select the most suitable flight paths into and out of the area, considering forced landing areas, and the long axis of the area.

(4) Plan the approach and select a point for touchdown.

Technique:

The high recon will be flown at 50 knots and cruise RPM. Normally, it is flown at 500 feet above the terrain and never downwind at less than this altitude.

If possible, fly in a complete circle around the area in order to observe it from all sides. You may, however, fly back and forth on one or more sides, or any other desired pattern to take advantage of forced landing areas. Observe the area from approximately a 30 - 45° angle. This degree of angle will allow you to make the best estimate of the height of barriers, presence of obstacles, size of the area, and slope of the terrain.

Divide your attention between flying the helicopter and your observation of the area. Be especially alert for other aircraft. Do not become so absorbed in your high reconnaissance that you forget about altitude and airspeed. Keep a forced landing area within reach if possible. Check the wind by observing smoke, water, wind mills, flags, or various other means. The wind will be an important factor along with the height of the barriers in 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′ 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 judgement when working a confined area or pinnacle. There is normally more than one solution in working any area, so learn to use your judgement 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 any 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' above the terrain and slow airspeed to 40 knots. Increase RPM, if appropriate for your type aircraft, to operating RPM below 500 feet. This portion of the maneuver is the base leg and conducted either crosswind 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 and you are ready to commence the low recon. Do not descend with a downwind condition.

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 of 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'.

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 the 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 the 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 into 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 the helicopter, level rotor disc with horizon, reduce engine RPM to proper setting, place the carburetor air in cold position, (OH-13 and OH-23) and apply friction to all controls. (Use mechanical lock when available.)

Technique:

As you exit the helicopter, be careful not to walk upslope under the main rotor. The ground recon can be broken down into four steps, as follows:

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

2. Walk back to the barrier or tree line in the downwind portion of the area, observing all barriers or obstructions in the area. Use the maximum amount of available area for take-off. Determine your take-off point by pacing off the distances necessary for maneuvering the helicopter plus a safety margin of 10 feet. For tail rotor clearance, pace off one helicopter length plus 3 or 4 paces (9 or 10 feet) from

the downwind barriers of obstruction. To obtain main rotor clearance, pace from the barrier to a point which approximated the distance from the mast to the barrier, to include the 10 foot safety margin. This is the point the nose of the helicopter will be over on take-off with the tail or main rotor 3 to 5 paces from any barrier. Place a sturdy marker, such as a heavy stone or log, at your take-off point. Make sure the marker will not blow away and can be seen from the inside of the helicopter.

3. Determine the hover plan. If the area is wide enough, plan your hovering straight forward after turning the helicopter around. Hover rearward only when the helicopter cannot be turned around. Hovering sideward is limited to only that distance necessary to afford proper clearance to complete a turn.

4. Return to the upwind portion of the area and recheck the wind to ensure that the wind has not shifted.

Ground markers used for turning the aircraft will be kept in sight at all times and all turns will be made around the marker. The laying out of the ground markers for rearward hovering may be placed along side one skid or the other, instead of directly beneath the helicopter, in order to obtain the best possible view of them. Rearward hovering markers will include a prepare to stop marker, four to five 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 up-slope.

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'.

Preparatory:

Release sufficient friction on the collective pitch and throttle (adjust carb heat, OH-13 and 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. 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.

Technique:

Take-off from the ground in s 30 knot attitude using the amount of power and angle necessary to clear the barrier by 10'. 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 or 27.5 inches in the OH-13H). The take-off path should be over the lowest barrier that allows you to take advantage of the wind and terrain. Clear the barrier that allows you to take advantage of the wind and terrain. Clear the barrier by 10, both vertically and horizontally. After clearing the barrier, resume a normal climb in the same manner as at a stage field.

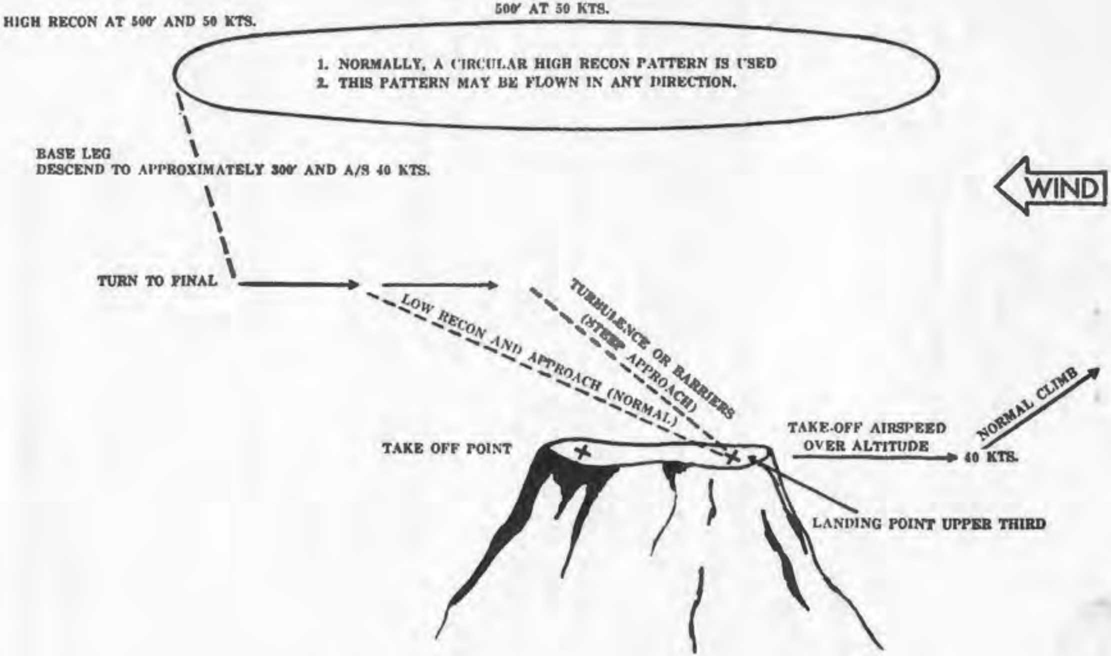
Things to Remember:

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

PINNACLE OPERATION

High Reconnaisance:

Same as for confined area operation.


HIGH RECON AT 500' AND 50 KTS.
500' AT 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.
WIND
TURN TO FINAL
LOW RECON AND APPROACH (NORMAL)
TURBULENCE OR BARRIERS
(STEEP APPROACH)
TAKE OFF POINT
TAKE-OFF AIRSPEED
OVER ALTITUDE
40 KTS.
NORMAL CLIMB
LANDING POINT UPPER THIRD

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 maneuvers). The approach (normal or steep) 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 a normal approach, execute a go-around and increase the angle to that of a steep approach. If excessive turbulence is encountered on a steep approach, 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. See page V-6 and V-7.

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. See page V-7. 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 be executed.

Preparatory:

Release the sufficient friction on the collective pitch and throttle (adjust carb. heat, OH-13 and OH-23), and make a magneto check. Release remaining friction and execute the hovering plan. Prior to take-off, clear the area for other aircraft.

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 headed 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 3 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. The maximum slope used will be 8°.

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 the 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 up slope.

Things to Remember:

Overcontrol or over use of the cyclic may result in mast bumping as well as landing on a slope that is too steep; however, if the slope is too steep, abort the attempted landing. Do not walk up slope 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.

ENGINE FIRE DURING STARTING

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 OVERSPEEDS

Engine overspeeds are often caused by careless or incorrect procedures and techniques. The cost each year is great, both in training time lost and in money for engine replacements and repairs.

To prevent overspeeds, rigid adherence to publicized procedures for starting, operation and shutdown must be maintained.

If an overspeed should occur, the pilot should carefully write up all the information about the over-rev, stating the amount of overspeed as closely as can be determined. State whether momentary and estimate length of time at this RPM. Each person, (pilot or mechanic) has a moral obligation to honestly record any overspeed experienced.

OH-13 E & G
(0335-5 Engine)

3410-3719 RPM - Land at nearest available landing area and shut down. Write up amount. The engine must be inspected by maintenance.

3720 RPM or more - Land at nearest available clear area and shut down. Write up amount. The hleicopter will be grounded for an engine change. Follow rules for precautionary landing.

OH-13H
(0435-23 Engine)

3520-3599 RPM - Land at nearest available landing area and shut down. Write up amount. The engine must be inspected by maintenance.

3600 RPM or more - Land at nearest available clear area and shut down. Write up amount. The helicopter will be grounded for an engine change. Follow rules for precautionary landing.

OH-23

3400-3599 RPM - Continue flight and write up amount of over-rev and length of time at this RPM.

3600 RPM or more - Land at nearest available landing area and shut down. Write up amount. The helicopter will be grounded for an engine change. Follow rules for precautionary landing.

TH-55

3200 RPM or more - Land at nearest available landing area and shut down. Write up amount of over-rev. The helicopter will be grounded for an engine <u>inspection or</u> change. Follow rules for precautionary landings.

ROTOR OVERSPEEDS

Rotor overspeeds may occur with needles joined in conjunction with and engine overspeed; however, an overspeed is more likely to occur during the flare or steep turn while autorotation.

To prevent a rotor overspeed, raise collective pitch a slight amount to reduce rotor RPM, then fully lower the collective when the RPM is at the correct setting.

<u>OH-13H, G & H</u>

<u>370 RPM or more - Land at nearest available clear area. Write up amount of overspeed and follow rules for precautionary landings.</u>

OH-23

415 RPM or more - Land at nearest available clear area. Write up amount of overspeed and follow rules for precautionary landings.

TH-55

540 RPM or more - Land at nearest available clear area. Write up amount of overspeed and follow rules for precau- tionary landings.

[illegible]OMETER FAILURE

Helicopters [illegible]ed with dual tachometers. One needle indicates engine RPM [illegible] other rotor RPM. If either needle should fail, the other will provide the information necessary to safely land the helicopter. 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.

Upon recognition of a frozen throttle, contact the controlling radio and declare an emergency. Decide upon emergency procedure to be followed and advise your controller of the plan. If at all possible, execute the landing at a stage field or the heliport.

A frozen throttle under full throttle condition will require some experimentation to determine if a descent can be established and executed without getting an excessive engine over-rev. 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 at a stage field. Continue to maintain engine RPM with collective pitch after touchdown and shut off magneto switch to stop the engine. NOTE: In the case of a low-time student who feels he is not proficient enough to make an autorotation, he should experiment until he finds the shallowest angle of approach that will give him the minimum amount of over-rev during a run-on landing.

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 cross-wind, (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), then 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

then 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 re-checked. This is especiallyttrue just before take-off and when you are using cruising power.

OH-13E, G & H

Instrument: On the OH-13 there is no carburetor air temperature maximum limit for safe engine operation, therefore does not require a high limit red line on the gauge. Detonation does not occur because of high carburetor air temperature, if the engine is operated within the allowable limits of engine RPM and manifold pressure. The yellow (caution) arc on the temperature gauge is from -2° C to +32° C and should be avoided.

CAUTION

Do not apply carburetor heat when OAT (outside air temp) is above 40° C (104° 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° Centigrade: Desired operating range.

Yellow Arc - 0° to 31° Centigrade: Caution operating temperatures.

Red Mark - 54° 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 needles to the desired operating range. For continuous operation, 45° C is the recommended temperature.

ENGINE FAILURE

(SEE FORCED LANDING)

Simulated forced landings are designed to prepare you for the possibility of an engine failure. In addition to the procedures used in the simulated forced landings, the fuel valve, mixture control lever, magneto switch and master switch should be turned off, if time permits.

FORCED LANDING

Student Solo:

(a) If radio is operative, call Wolters Tower, Stage Field Control or Aircraft flying in vicinity.

(b) Aircraft flying in vicinity may be signaled by:
OH-13 and OH-23, aligning main rotor blades perpendicular to the fuselage.

TH-55, 1 blade straight out in front.

(c) Secure the aircraft and do not fly under any circumstances.

(d) Stay with the aircraft until you are relieved (except when necessary to telephone notification). Phone No. FA 5-2581, Ext. 25 or 505.

(e) Complete and submit report of forced landing to Director of Flying Safety.

ACCIDENT OR INCIDENT

(a) Notify Wolters Tower or Stage Field Control.

(b) If not injured, stay with aircraft until relieved (except when necessary to report accident by telephone.

(c) Report to Flight Surgeon as soon as possible, always before next flight.

(d) Submit report of accident to Director of Flying Safety.

(e) Report to Flight Commander for Post Accident check ride.

PRECAUTIONARY LANDING PROCEDURE

(a) Notify Wolters Tower, Stage Field Control, or aircraft flying in vicinity.

(b) Stay with aircraft and do not attempt to fly the aircraft until it is inspected and released by qualified personnel.

GROUND RESONANCE

TH-55A

Ground resonance is a vibratory condition present in the helicopter while on the ground with its rotor turning. Usually, only 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 helicopter 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:

Th‹ ›rpose of this demor ›ation is to enable y 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 3′ and 90° to the left of wind direction.

Technique:

With the crosswind 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. The cyclic is used to prevent drift. When 90° of turn have been completed and the helicopter is into the wind, close the throttle to stop the turn. Closing the throttle will eliminate the torque and cause the turn to stop. Complete a hovering autorotation at this point, using the techniques outlined for hovering autorotations.

Things to Remember:

The helicopter should be kept in a level attitude throughout the turn.

SETTLING WITH POWER

Purpose:

This critical condition of flight is demonstrated for the single purpose of preparing you to recognize and recover from it. The term "settling with power" is used to describe a flight condition which produces high vertical rates of descent and loss or partial loss of control effectiveness. It is sometimes described as settling in your own downwash.

Preparatory:

To demonstrate this maneuver, use an area which is well away from stage field or other traffic. Settling with power will be demonstrated at an altitude of at least 1000 feet above the ground, and the recovery made not lower than 500 feet above the ground. Three prerequisites are necessary to induce settling:

1. An airspeed of near zero
2. 20 to 100% of the available engine power applied to the rotor system to create downwash.
3. A vertical rate of descent of 300 feet per minute or more.

Technique:

Make a clearing turn into the wind to determine if the area underneath is clear. Maintain hover RPM. Raise the nose of the helicopter to reduce airspeed to zero. After zero airspeed is obtained, initiate a downward rate of descent by lowering the collective.

When the desired rate of descent is established, increase collective pitch to induce settling with power. The helicopter will begin to buffet and vibrate. There will be a "feed back" in the controls and the rate of descent will increase. The helicopter is now in settling with power. The recovery should be made by increasing forward speed to move out of the column of disturbed air; lower the collective pitch and maintain RPM. Increasing forward speed will normally recover from this condition with a minimum loss of altitude.

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.

SECTION VII

NAVIGATION

Aerial navigation is the art of flying an aircraft from one point to another and determining its position at any time along the route. Up to this point you have devoted all of your time in training to practicing maneuvers which developed your ability to control the aircraft in all flight attitudes. In developing this skill, you have had little chance to appreciate the aircraft as a means of transportation. Flying from one place to another is an important part of almost any mission you will accomplish later on, the cross-country flying that you will do in School will be valuable training and will give you the fundamentals of aerial navigation. You will have the opportunity to work practical problems in navigation and to apply the knowledge you have acquired in the classroom.

Prior to your first solo day navigation flight, you will be given a dual familiarization ride. Your instructor will show you how to identify check points, compute ground speed, and make off-course corrections. He will also give you a chance to navigate so that he can check your proficiency prior to your first solo navigation flight.

Chart Preparation:

There are many factors to consider in preparation for a navigation flight. These factors will vary, moreover, with the condition under which the flight is to be conducted. The weather, range, landing and fueling facilities, and frequency of check points along the proposed route will also influence your preparation.

The first step is to select a chart which includes the area over which you will fly. There are many types of charts, each having its advantages and disadvantages. The Sectional Chart will be used because of the relatively short distances you will be flying and also because the main supporting type of navigation will be pilotage. The large scale of the Section Chart makes it more appropriate for pilotage techniques. Since a given area of the chart represents a relatively small portion of the ground, considerably more detail is shown on the chart.

After you have selected the proper chart, the next step is to draw the course line from the point of departure to the point of destination on the chart and determine the true course and distance. The course line can be drawn with either black or colored pencil. Do not use red pencil as red lines will not show up at night under red cockpit lights. The important thing is to make sure that it can be easily seen. Apply variation to the true course to fly magnetic course. When your flights extend over longer distances, the course will be broken into shorter "legs" and variation computed for each leg. If variation is west, you should add it to the true course. This can easily be remembered by the saying "East is least and West is best." After you have applied this correction, write the magnetic course in large numbers on the right side of the course line and indicate the direction of the course by means of arrows. Now measure the length of the course. This can be done by using the appropriate scale on either the plotter or the bottom of the chart. You should be careful to use the statute-mile scale if you are using statute measurement. All facts used should be expressed in terms of common measurement. After you have determined the distance of the course line, you should write the distance directly below the magnetic course that you have just written on the chart. The next step is to place a small pencil mark to the right side and perpendicular to the course line at each ten-mile interval. At each twenty-mile interval, you should write in the total distance to that point on the course line; that is, 20, 40, 60, and so forth.

You have now completed your chart for the first leg of your flight. Do the same for the remaining legs. Remember that the mileage should be begun anew at the beginning of each leg.

After you have prepared the chart for the entire flight in the manner described above, start over, this time measuring and marking the courses in the opposite direction. Label the courses and mileages on the right side of the course line as before. Since you are now going in the opposite direction, however, the data will be on the opposite side of the course line. The reason for preparing a chart in both directions is that in flight training, part of the students will fly the course in one direction and the remainder of the students will fly the course in the opposite direction. You may not know until the briefing just before the flight which direction you will be flying.

Route Survey:

After you have completed the chart, examine the route very carefully. Note the following:

1. Elevation of terrain (with particular attention to hills or peaks).
2. Restricted, warning, and prohibited areas.
3. Emergency landing fields.
4. Location and frequency of check points.

A landmark used to establish the position of the aircraft is called a check point. It will also enable you, during flight, to compute ground speed and arrival time quickly and easily. A check point should be a unique feature or group of features along or close to your course. A town at one corner of a lake, with an identifying highway or other feature would be an excellent check point.

There will be the possibility, however, that the check point you have chosen will be mistaken for some other group of similar features. Also, in arid regions or areas affected by drought, lakes and rivers may not appear as such on the ground. If this is the case, position identification may sometimes be made by continuing on course and checking another reference point that will positively identify the check point.

In forested areas, the swaths cut for pipe lines or power lines can serve as good reference lines. In mountainous areas, where check points are few, such minor features as ranches or houses may be used.

The check points generally should not be more than fifteen minutes flying time apart. Sometimes the nature of the terrain will make the distance greater. The value of having check points close together is that corrections can be made before you fly too far off course.

After you have selected your check points, mark each one by drawing a circle around it so that it can be easily found on the chart during flight.

The Flight Log:

The next step in preparing for the flight is to fill out the flight log. The Flight Log is a record of all courses, headings, distances, speeds, check points, and other data important to the successful completion of the flight. It provides you with an organized record and schedule for the flight.

There are many forms of flight logs, each designed for a particular purpose. The Flight Log that you will use lists only information which is fundamental to a navigation flight.

Preparing The Flight Log:

First enter your name, the date, and the navigation flight to be flown. Then enter the total distance and true courses as measured on your chart. Now enter in the space provided the variation that you previously found for each leg. Remember that wind speed is usually given in knots.

The next step is to fill in all the data pertinent to the navigation flight. Write, in the spaces provided, the names of all of your check points in their proper order. Now fill in the column labeled "Distance from last Check Point." Notice, there is a horizontal line dividing each space into equal halves. In the top half you should write the distance of each check point from the previous check point. In the bottom half you should write the total distance from the beginning of the leg to the check point. Notice that the space for the first check point has no horizontal line. This is true because the distance from the last check point and the total distance will be the same. Now follow the same procedure for the remaining legs. Normally, this will be accomplished by the class as a group so that all students will have the same check points in order to simplify the briefing before the flight. You have now completed as much of the log as you can prepare before the briefing for the flight.

On the day you are to make the navigation flight, additional data will be available to enable you to complete your pre-flight preparation of the flight log. Winds aloft, temperature aloft, flight altitudes, and cruise control data will be posted for your use. With the use of your computer, calculate true airspeed, true heading, ground speed and estimated time enroute to the check points. Now you can compute your magnetic heading by applying variation to the true heading. This correction is made in the same manner as you corrected true courses for variation. Remember, east is least and west is best. Enter the magnetic headings in the space provided. After you have done this, you will be able to fill in the blanks labeled "Wind", "Drift Correction", "True Heading", "True Airspeed", "Ground Speed" and "Time from last Check Point". Notice that the blanks under "Time from last Check Point" have a line diagonally across them. In the top space opposite the first check point there is no diagonal line, since the time from the last check point and the total elapsed time would obviously be the same. After you have entered all this data, add the total time for each leg and enter this time in the blank labeled "Total ETE". This is the total time you expect to fly on the navigation phase of the flight; that is, excluding take-off and landing.

Now check your log. The only blanks you should have are those for deviation, compass heading, departure time and the columns labeled "ETA", "ATA", and "Notes". These will be filled out after you go to the aircraft and during flight.

Pre-Flight Briefing:

Just prior to the flight there will be a briefing of all students. The purpose of the briefing is to tell you just what will be done and how it is to be done. The briefing will include all of the pertinent data necessary for the successful completion of the flight, and it will give you the opportunity to check your own computations. It will also include any information peculiar to your Primary flying school. All briefings will cover the following main points:

1. Aircraft assignment and take-off interval for each student:

Take-off interval will be expressed with reference to H hour. For example, the first aircraft will take off at H hour, the second aircraft at H plus two, the third aircraft at H plus four, and so on. Later on, either during the briefing or after the briefing, H hour will be announced. Suppose that H hour is 0930 hours. This means that the first aircraft will take-off at 0930, the second at 0932, and the third at 0934.

2. Route briefing:

Check points and danger, caution and restricted areas.

3. Flight log data:

Cruise control, true airspeed, winds aloft, speeds, variations, magnetic headings, estimated time between check points.

4. Weather:

Forecast weather and weather along the route.

5. Communications and "lost" procedures.

After all the information has been covered, you will have an opportunity to ask questions. Do not start cross-country with any unanswered questions in your mind.

When all questions have been answered, the briefing will be concluded. At this time your instructor will check your charts and log computations to make sure that you have properly completed all the details. He will also answer any last-minute questions you may have.

The Flight:

You are now ready to begin the navigation flight. Before you can go out to your aircraft, make sure that you have the following items: charts, flight log, plotter, computer, and a pencil. When you get to aircraft, go through your regular inspection and checks, paying particular attention to the fuel tanks. Never take off with tanks that are not completely full. In an emergency, that extra 5 gallons may mean the difference between landing safely and landing short of the runway. After you are in the cockpit and have completed the normal checks, note the correction necessary for deviation as recorded on the deviation card for each of your magnetic headings. Write these corrections in the proper blanks on your flight log. Now apply these corrections to the magnetic headings and write in the compass headings in the proper spaces. These are the headings that your magnetic compass should indicate when you are flying in the proper direction.

You should allow plenty of time in your planning to enable you to take-off at your previously assigned take-off time. Before take-off, be sure to set your altimeter at the field elevation. Later in your training you will put the altimeter setting in the Kollsman dial and check the hands for field elevation. When you do this, the maximum allowable error is 75 feet. The advantage of using this method is that when you call in for landing instructions, either on return to home base or on arrival at another field, the tower will normally give you a new altimeter setting. This new altimeter setting will adjust your altimeter for the existing pressure at your destination. When you land, the altimeter will indicate field elevation.

Setting Course:

After you have climbed to your flight altitude, intersect your first heading. This is called "setting course". Note the time that you set course and write this time in the space labeled "D". Before setting course, you should have accomplished your cruise-control procedure and have attained the proper indicated airspeed. The reason for setting course directly over the field and at your proper altitude is that your time enroute computations will be more accurate, Later on, when you are more familiar with navigation techniques, it will not be necessary for you to climb to your altitude before setting course;you will climb on course instead. The lower airspeed used for the climb will be computed on the log.

In-Flight Procedures:

As you continue on course, you will want to check your progress over the ground by referring to the chart. The easiest and most convenient way to use the chart is to have it folded neatly, with only the particular area over which you are flying exposed. Align the chart so that the course line on the chart lies in the same direction as your aircraft heading. In this manner your check points and other landmarks will appear on the ground in the same relative position as they do on the chart.

During the time it takes you to reach your first check point, you can bring your flight log up to date. Draw a diagonal line across the space in the column labeled "ETA" and "ATA" (estimated time of arrival and actual time of arrival). Now add the time under the column "Time from last check point" to the time of setting course and enter this in the top space of the "ETA" space. When you arrive at the first check point, note the time of arrival and enter it in the bottom space of "ATA" space. If every factor has been accurate and your computations correct, these two figures will be the same. In actual practice, however, your winds aloft information may be in error, and a slight correction will be necessary. If the actual time of arrival is not the same as the estimated time of arrival, it will be necessary to re-compute the ground speed with your computer, using the time, rate and distance method which you learned in the classroom.

Enter this new ground speed under the "Notes" column and use this speed to compute your next ETA. If you are off course, you should compute your correction to converge on the next check point. This is the practical application of "off-course correction" on your computer as learned in the classroom. Estimating how far you are off course will require some practice. The more altitude you have, of course, the smaller distances appear. It will be necessary, therefore, to take into consideration your altitude above the ground. Care should be taken that your time checks are accurate and that you have maintained your heading. If you fail to hold your heading or do not record your time correctly, you cannot expect your next correction and ground speed computation to be accurate. Now do the same thing at your next check point. If your latest off-course correction and ground speed computation have been accurate, you will arrive at the next check point on your ETA; and you will be on course when you get there. The only thing you will have to do then is take up your new heading or heading to parallel.

Strange Field Landings:

On one of your navigation flights you will make a landing at a field other than your home base. This is called a strange field landing. Before landing at a strange field, you should be thoroughly familiar with all the pertinent information regarding the field. You will be concerned with direction of runways, elevation of field, landing hazards, and obstacles in the vicinity of the field. After you are graduated from flight training, you will have to find all of this information for yourself from the appropriate publications. (You will be told most of the necessary information during the briefing just before the flight.)

When you arrive at a strange field, make a normal traffic pattern and land. Be alert for hazards. Remember that the elevation of this field will probably be different from that of your home base. For this reason your traffic pattern attitude will vary accordingly. After your landing, you will hover to a refueling area, refuel and take-off to continue your flight.

Things to Remember:

Do not keep your head in the cockpit for too long a period of time. Remember to look around just as you did on your local flights.

Remember that although each flight will be different in specific details, in the future the same fundamentals that you have learned will apply to each navigational flight you will make.

LOW LEVEL NAVIGATION

Purpose:

Low level navigation is becoming increasingly important to Army Aviation as our concepts develop the future battlefields. A future battlefield indeed, but never forgetting the ancient tactics of successful military men of all time—Surprise, deception, and speed.

Low level flights present uncommon and unique navigational problems. We must recognize these problems and compensate for them in our planning of the mission.

Low level flights have 3 main advantages:

1. Limits enemy observation capability
2. Reduces radar detection
3. Element of surprise

Disadvantages to low level operations are:

1. Reduces observation
2. Reduces time to react in special situations
3. Poor radio reception
4. Turbulence more critical to safety

Preparatory:

Map selection: A map of 1:250,000 or 1:500,000 scale may be adequate for flights from point A to point B.

In airmobile operations where precise navigation is required, a map of 1:50,000 scale is recommended.

The most important aspect of preflight planning is the selection of the flight route. When selecting a route, consideration must be given to the mission, terrain, weather, and location of enemy forces and air defense weapons. There are three means of insuring enroute orientation:

1. Air control points (ACP) which define the route of flight, critical points and turning points. ACP's should be well defined and easy to see.

2. Check points along the intended route of flight to maintain course heading.

3. Barriers at each turning point or area of possible points of confusion.

Map preparation: There are certain essential items that must be placed on the face of the map. These are APC's, course lines, magnetic headings, and time tic marks. Other items recommended are check points, distance and barriers.

Technique:

As soon as possible after take-off, establish the desired heading, altitude, and airspeed. Cross checks of your map and the terrain are necessary to establish and maintain the desired course.

By computing the time from take-off to the first check point, you can determine the time to each check point and the first ACP or turning point. This will also enable you to recompute fuel consumption and allow for changes in airspeed if it is necessary to arrive with ample fuel.

Should it be necessary to deviate from the desired heading along a specific leg in order to by-pass danger areas or hostile air defence locations, the following procedure is recommended:

1. Determine the degree of bearing change required to safely by-pass the area.

2. Turn to this heading and fly for a given time.

3. To return to course, double the degree of bearing change and apply it in the opposite direction.

4. When a time equal to that flown outbound has elapsed, return to heading of the initial course.

5. Check correct flight path by rechecking the map with the terrain.

After a deviation of desired heading, it becomes necessary to recompute time to ACP or target area.

Things to Remember:

The most important thing to remember during enroute flight is do not forget you are flying and do not keep your head inside the cockpit for long periods of time. **Be alert.**

SECTION VIII

NIGHT FLYING

Introduction to Night Flying:

Purpose:

Night flying is a very important phase of your pilot training. It is another step toward making you an all-around Army Aviator. This phase is designed to make you a proficient flyer at night.

Night vision will be useful later in your career. Take heed of the facts presented here; practice night seeing and increase your effectiveness as a pilot.

Preparatory:

There are three reasons why it takes training and practice to improve your night vision. Your mind and your eyes are a team. To see well, both members of this team must be used effectively. Your eyes are formed in such a fashion that you must learn to use them differently at night than you do during the day. Your eyes do not automatically tell you what you see as they do in the daytime, and familiar things appear differently. Therefore, it takes practice to recognize objects which your eyes see at night.

Techniques:

You cannot see in the dark unless your eyes are adapted, and since it takes 30 minutes for this process to take place, the first rule is to adapt your eyes and keep them adapted.

Red light is harmless and will not injure your eyes. It has only one disadvantage—you will not be able to see red markings on maps and charts.

When you catch an object out of the corner of your eyes, try to hold your eyes just a bit off center so that you will have the object at the point of maximum sensitivity. If your eyes move irresistibly toward the object, let them swing through so that you can pick it up again at the other corner of your eyes.

If you see an aircraft or object and then lose it, do not try to bore the darkness to find it again. Instead of staring at the spot where you lost it, move your eyes around the spot in a circle focusing always slightly away from that point.

Of course, you cannot read instructions on charts without lights, but you can use as little light as possible. Always study your charts thoroughly before a flight so that you will not have to pore over them during flight. Staring at instruments tires the eyes and may reduce effective vision as much as 50 percent. While flying with lighted instruments, look at them as briefly as possible and keep all lights turned low.

Learn to move your eyes frequently in dim light. As you search, do not sweep the sky or sea at random; scan by searching a small area carefully and then jumping your eyes to the next area. You can see very little while your eyes are in rapid motion, but they are sensitive just after moving. Move them in short jumps so that you see all parts of the search area in succession. Move your eyes more slowly than you would move them in daylight. Blink your eyes if an image becomes blurred.

Since this type of seeing is not second nature, you will have to practice it until it becomes automatic. Remember that every bit of training and practice you give night seeing will repay you in better seeing.

Depend on the size of an object and the contrast between the object and its background to see it. This means that at night, familiar things look quite different from the way they look in daylight. Since you have not had as much practice in night seeing, objects are also harder to identify.

Your eyes furnish you with so little information at night that you must be able to interpret the smallest clues in order to identify the objects your eyes pick out. Night conditions are so varied that it is impossible here to go into detail on night recognition. The important thing is for you to use every night flight to learn more about night seeing.

A common experience in night flying is vertigo, dizziness, special dis-orientation, or whatever you want to call it. It is sometimes worse just after a take-off from a lighted runway. The sharp change from bright light to utter darkness brings on an eerie feeling that everything is going awry.

At night it is important for you to keep your windshield and windows clean and unscratched. Tests prove that a thin film of oil or dust on a windshield will reduce visibility by more than 50 percent. Haze, fog, dirt, scratches—anything that absorbs or scatters light—reduce contrast and make things harder to see. You cannot do much about haze or fog, but you can keep your windshield clean.

At night, vision is the first thing affected by the lack of oxygen. If your job in the air calls for sharpness of night vision, and if oxygen is available, use it from ground level on up. Your night-seeing margin is so small that the slightest lack of oxygen affects your seeing: At altitudes over 5000 feet, instrument markings seem dimmer. You begin to turn up the panel lights to see better. The more you turn up your lights in order to see inside your helicopter, the less you can see outside. You impair your night adaptation at the same time the lack of oxygen is making your eyes less efficient.

If you are a victim of vitamin shortage, this deficiency will impair your night vision. However, if you eat a well-rounded diet, extra doses of vitamins will not increase your night-seeing ability.

Smoking and drinking heavily, as well as the use of many drugs, may reduce your night vision; so avoid these harmful habits. Since fatigue also impairs your vision, get plenty of rest.

Things to Remember:

Adapt your eyes and discipline yourself to keep them adapted.

Learn and use the techniques that give your eyes a break.

Night Flying at a Stagefield:

Purpose:

The primary purpose for night flying at a stagefield is to demonstrate the night flying procedures and techniques to the student; also, to allow the student to become proficient in night flying while subject to control supervision.

Preparatory:

Restricted vision present in night flying requires that all aircraft operating in the confines of a traffic pattern conform strictly to prescribed procedures. Preceding night flying, all students will be briefed thoroughly on night flying procedures.

Your instructor will show you the local flying area, any prominent landmarks, cities or towns, and any points of interest that may help keep you orientated.

Technique:

Call signs will be assigned preceding night flying, and are to be used at the stagefield for radio calls instead of the aircraft number.

The call signs will indicate the traffic that will be used at the stagefield.

Aircraft to be used in night flying will be preflighted prior to darkness so that a close visual inspection may be accomplished.

In addition to the normal prescribed pre-flight, the navigation lights, landing light, and instrument lights will be checked for proper operation.

All students will assist in accomplishing the initial pre-flight inspection on the aircraft they are assigned to fly.

No aircraft shall be used for night flying that does not have a properly operating radio (transmitter and receiver). Be sure to check the radio during warmup.

To depart the Main Heliport, obtain take-off instructions as in normal day flying.

Use landing light while hovering at the Main Heliport during darkness and proceed with extreme caution.

Normally, a regular day-traffic entry will be used in the traffic pattern with the exception of radio calls. The instructor will usually demonstrate the first landing to you. You will then take over the aircraft and execute landings until your instructor releases you for solo. Dual landings with and without landing lights will be required. At least one practice go-around will be required.

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 Page No 8, 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° 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.

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) and 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 crosswind.

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 Fort Wolters 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 and move to a position parallel to the take-off position of an adjacent lane. Control will issue instructions.

As the forced landing is initiated, the student will enter autorotation. The landing light will be turned on as soon as possible. A power recovery will be executed prior to reaching 200 feet above the terrain.

Aircraft departing the stagefield and entering heliport traffic will break the traffic 45° to crosswind leg and the pilot will call the 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 main 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 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.

SECTION IX

FORMATION FLYING

Purpose:

Two or more aircraft, holding positions relative to each other and under the command of a designated aviator constitute a formation.

Formation flying is required to move groups of aircraft with minimum confusion in the shortest length of time in order to facilitate the elements of surprise and allow mutual support. Formation flying is not dangerous when flown correctly. It becomes dangerous only when the basic principles involved are violated.

Preparatory:

In a tactical situation, the great majority of flying will be in formation. Formation flying requires the pilot's undivided attention and skill. It is imperative that every pilot become familiar with the principles involved in both day and night formation flying, the duties and responsibilities of the pilot as well as co-pilot, and most important, the necessity for flying discipline.

Types:

There are three basic types of formations:

a. Echelon (right and left)
b. V-Formation
c. Trail Formation

Fig. 1 **Left Echelon:**

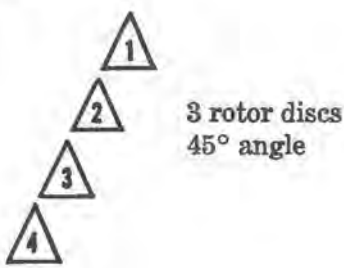


Fig. 2 **Right Echelon:**

3 rotor discs

45° angle

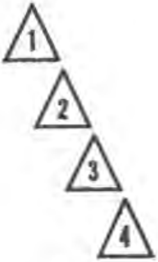
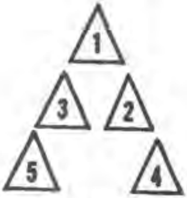


Fig. 3 **V - Formation:**



3 rotor discs

45° angle

Fig. 4 **Trail Formation:**

3 rotor disc

There is lateral as well as vertical separation in all of the formations. Lateral separation is normally three (3) rotor discs at a 45° angle. Vertical separation is normally one to three (1-3) feet stepped up from front to rear of the formation.

During preparations for a formation, the first important point to acknowledge is the fact that each number of the flight is a team member and should be prepared to take the lead and know what is expected of each member and each position. Know the hand signals and radio frequencies to be used. The designated flight leader should plan all climbs, turns and descents so that there are no abrupt movements and, whenever possible, hold a constant airspeed and altitude.

The flight leader, in determining the type of formation to be used, considers the following items:

a. Objectives of the mission.

b. Simplicity to permit easy control, facilitated flight discipline and afford reconnaissance capability.

c. Flexibility to meet different situations and ability to quickly close up to fill vacancies.

d. Mutual support and maximum protection.

e. Maneuverability for evasive tactics.

f. Provisions for rapid development of combined offensive and defensive power.

Technique:

Formation flights are normally started on the ground. It is desirable to have an area large enough to accomodate all of the A/C in the formation. This allows each pilot to get into the correct position and space himself laterally. When signaled by the formation leader, roll the throttle to proper RPM. Be alert for the lead A/C or the A/C in front of you getting light on the skids.

During take-off in formation, constant power settings may be disregarded. Apply necessary collective pitch and power, maintaining proper RPM to retain lateral separation as well as climb with the formation. Maintain directional control with pedals until approximately 50′ above the ground at which time the A/C should be allowed to go into a normal crab.

Upon reaching the point where a turn is initiated, the aircraft's position in the flight will dictate the necessary maneuvers. For example, in a turn, A/C on the inside will have to dissipate airspeed. A/C on the outside will have to increase pitch and airspeed so that when the turn is completed, all aircraft will be in their original positions, properly spaced.

When in straight-and-level flight, learn to judge the distance from the lead A/C in number of rotor discs. The instructor will point out reference points in the lead A/C to be used to maintain a 45^{o} angle. The vertical separation of 1-3 feet will be automatic after a little practical experience.

In order to become more proficient in formation flying, anticipate all turns, climbs, and descents. Make every move that the lead aircraft makes and always close on the lead A/C slowly and cautiously. Keep a constant separation in the flight both vertically and horizontally. The slightest deviation constitutes an accordian action throughout the remainder of the formation. This holds true for take-offs, in flight, and landings.

The formation leader will normally plan all landings to avoid turbulence and rotor wash, if possible. For example, if there is a right cross-wind, the formation leader alters the formation to right echelon in an effort to avoid turbulence from rotor wash from other A/C. Landings will normally be started at 300' to 45 knots. Maintain RPM and use whatever power is necessary to complete a normal approach. Maintain separation as stated in take-offs and in flight maneuvers.

Things to Remember:

a. The co-pilot should monitor instruments and navigate.

b. Be sure to receive or give a thorough briefing prior to each formation flight.

c. If staging area does not allow a line up for take-off, A/C may link up after they are airborne.

d. If the landing zone cannot accomodate all of the formation, A/C may land as prescribed by the flight leader.

e. Proficiency in determining lateral and vertical separation comes with flying experience.

SECTION X

STUDENT INFORMATION

2 6 - 17

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
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) T1C - Primary Training (Student)
- (b) T2C - Advanced 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
- (h) T6 - Successful End of Stage P or ADV Check-Ride

PARKING PROCEDURE

OH-23D

All helicopters will be parked with the wind from the right rear, approximately 135° 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

In emergencies, 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 clothing on rotating elements and avoid scratching the drive tube with rings. Remove gloves before attempting this procedure.

ALLOWABLE FLYING TIME

OH-13E

(a) Each fulll tank of fuel:
Solo - 01:30
Dual - 01:45
(b) Only in the event of an emergency may these limitations be exceeded. (Not to exceed 01:45 solo)

OH-13G & H

(a) Each full tank of fuel:
Solo - 01:30
Dual - 02:00
(b) Only in the event of an emergency may these limitations be exceeded. (Not to exceed 02:00 solo)

OH-23D

(a) Each full tank of fuel:
Solo - 02:00
Dual - 02:15
(b) On in the event of an emergency may these limitations be exceeded. (Not to exceed 02:15 solo)

(a) Each full tank of fuel:

Dual - 02:00
Solo - 02:00

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

STAGE FIELD OPERATIONS

Flags at Stage Fields and Lights at Heliports:

(a) GREEN - Dual and solo
(b) YELLOW - Dual only
(c) WHITE - Return to Parking area
(d) RED - Flying canceled. Return to Heliport

DENSITY ALTITUDE COMPUTATION

(Approximate)

Density altitude = Pressure altitude + 120K (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° C minus 2° C for every 1, 000 feet above sea level.

Sample Problem:

Field Elevation = 1, 000 feet
Pressure altitude = 2, 000 feet
Actual Temp. = 25° C.
Std, Temp = 11° (Std. sea level 15° - 2° for every 1, 000 feet)
Density altitude = 2000 + 120K
$(25^{\circ} - 11^{\circ})$
=2000 + (120 x 14)
=3680 feet

PHONETIC ALPHABET

A - Alfa .—
B - Bravo —...
C - Charlie —.—.
D - Delta —..
E - Echo .
F - Foxtrot ..—.
G - Golf — —.
H - Hotel ....
I - India ..
J - Juilet .— — —
K - Kilo —.— (Pronounced Key-Loh)
L - Lima .—.. (Pronounced Lee-mah)
M - Mike — —
N - November —.
O - Oscar — — —
P - Papa .— —.
Q - Quebec — —.— (Pronounced Key-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 - tree
4 - fo-wer
5 - fife
6 - six
7 - seven
8 - ait
9 - ni-ner

STUDENT INFORMATION SECTION

DEMPSY FEILD

FACILITY	CALL SIGN	UHF	VHF	FIELD ELEV	TRFC ALT
Heliport East	Wolters Tower	241.0	141.40	892'	1800'
Heliport West	Wolters Tower	229.[illegible]	141.[illegible]0	892'	1500'
Downing Hpt	Downing Tower	~~229.6~~ NO FAR	139.20	964'	1500'
Stagefield #1	Pinto	230.1 ~~248.2~~	141.05	1003'	1500'
Stagefield #2	Sundance	231.0 ~~248.4~~	142.95	1013'	1500'
Stagefield #3	Ramrod	248.6	149.60	955'	1500'
Stagefield #4	Mustang	248.8	139.45	1094'	1600'
Stagefield #5	Rawhide	~~[illegible]~~	149.90	845'	1400'
Stagefield #6	Bronco	229.7 ~~257.9~~	148.80	1053'	1600'
Stagefield #7	Wrangler	248.4 ~~257.9~~	141.20	1040'	1600'
Tactical Fld	An Khe	231.2 ~~248.8~~	143.30	1010'	1500'
Tactical Fld	Bien Hoa	229.6 ~~257.4~~	148.[illegible]	1070'	1600'
Tactical Fld	Da Nang	248.7	143.20	1120'	1600'
Tactical Fld	Qui Nhan	231.1 ~~248.2~~	139.35	1125'	1600'
Tactical Fld	Tuy Hoa	248.5 ~~248.4~~	139.15	1282'	1800'
Tactical Fld	Vinh Long	246.7 ~~241.1~~	141.30	1220'	1700'
	CAMAON		131.1		
	CAN THO	246.1	142.3		
Refuel Area	Pleiku	246.3 ~~241.2~~	143.40	968'	1500'
Refuel Area	Soc Trang	229.6 ~~257.7~~	142.35	908'	1400'
Air to Air	Cross Country	229.3	142.30 119.95		
Air to Air	Cross Country	242.4	143.05 132.05		
Air to Air	Cross Country	246.2	143.10 132.85		
Air to Air	Cross Country	246.5	148.80 ABJINE FLACO		
Air to Air	Cross Country		149.75		
HUY NIN		24.63			
FAA Radio		255.4	126.70		
Emergency		243.0	121.50		
MED VAC.		241.0			

RADIO FREQUENCY CHANGE # 1 (5 April 1967)
(Effective 17 April 1967)

3636
Fort Wolters..............................FA 5-2581

CAP. GOLDSMITH 3437
Dir, Mil Flt Div.........MAJ HORTON....580/581-3603

2438
Wolters Tower.................................25

Fixed Wing Operation..................691/692/693

Center Safety................................473

Weather..................................516/536

MWL Airport FSS.......................FA 5-5922

TMC.............................508/507/505/506

Mil Flt Br.......................586/588/587

Flt Eval..................................252/554

Post Trans....................................61

SF # 1......................................348

SF # 2......................................345

SF # 3......................................344

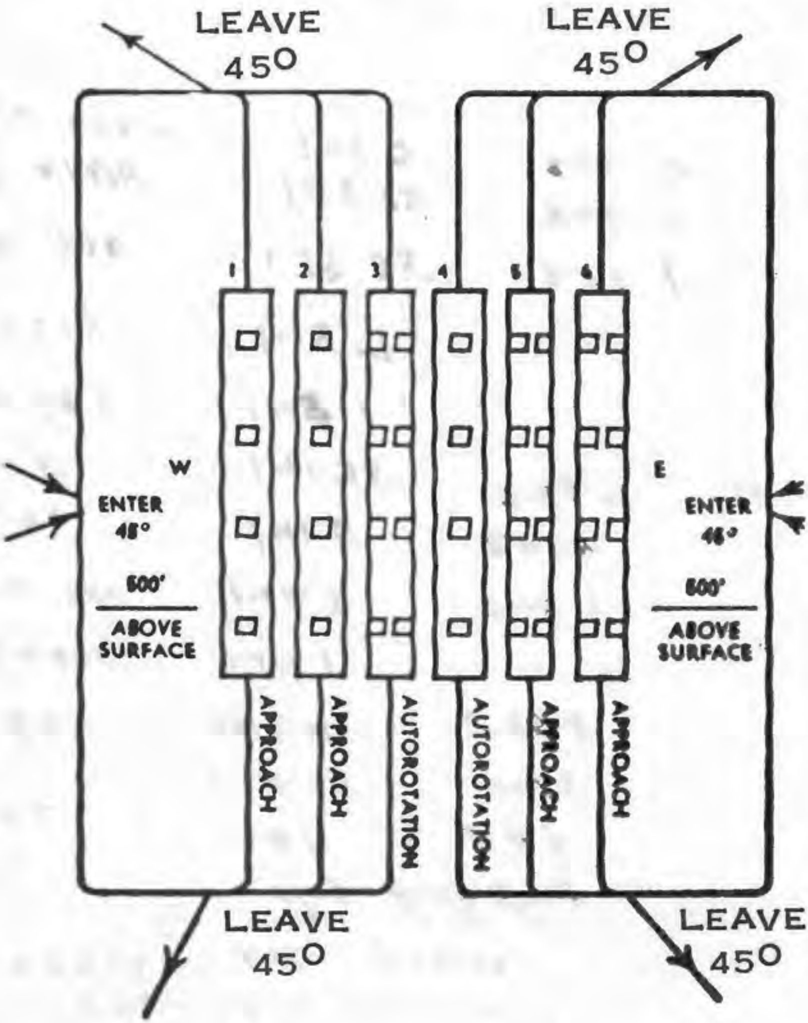
SF # 4......................................353

SF # 5..................................FA 5-2411

SF # 6......................................666

SF # 7......................................667

STANDARD TRAFFIC PATTERN
FOR STAGE FIELDS



PHONE NUMBERS WEST MILIPORT

Pattern attached

OL-9-3001 CAPT. GOLDSMITH

OL-9-3011 MAJ HORTON

stage field freq

	VHF	UHF	
BAC	148.75	241.1	
BEN CAT	141.4	248.5	2,000
CAMRON	134.1		
CAN THO	142.3	245.1	
HUHI	141.5	241.4	
HUE	141.35	246.4	1600
MY THO	148.1		
FULIY	148.7		
KIN YON	139.35	231.1	
TAY NINH	148.85	246.3	
BEN LONG	141.3	245.7	

SECTION XI

GLOSSARY

AIRFOIL—A surface that develops a useful dynamic reaction from the air.

AIRSPEED—The speed of an aircraft in relation to the air through which it is passing.

ALTIMETER—An instrument for indicating the relative altitude of an aircraft by measuring atmospheric pressure.

ALTITUDE—The elevation of an aircraft. This may be specified as above sea level, or above the ground over which it flies.

ANGLE OF ATTACK—The acute angle formed by the chord line of the airfoil and the relative wind.

ANGLE OF INCIDENCE—The acute angle formed by the chord of the airfoil and a longitudinal reference line on the helicopter.

APPARENT RATE OF CLOSURE—A term used to describe the rate at which an area on the ground appears to be moving toward the viewer during the helicopter's descent.

ARTICULATED ROTOR—A rotor system whose individual or collective main rotor blades are free to flap, feather, and hunt individually or collectively.

ATTITUDE—The position of an aircraft considering the inclination of its axes in relation to the horizon.

AUTOROTATION—The process of producing lift with airfoils which rotate freely and are not engine driven. When a helicopter enters into autorotation, the flow of air is upward through the main rotor system, rather than downward, as in the case when the rotors are engine driven.

AXIS—The theoretical line extending through the center of gravity of an aircraft in each major plane: fore and aft, crosswise, and up and down. These are the longitudinal, lateral, and vertical axes.

BANK—To tip, or roll about the longitudinal axis. Banks are incident to all properly executed turns.

BLADE—One airfoil or a rotary-wing system used for lift and directional control.

CEILING (meterology)—The height of the base of the clouds above the ground.

CEILING (aircraft)—The maximum altitude the aircraft is capable of obtaining under standard conditions.

CENTER OF GRAVITY (CG)—An imaginary point in a body where the resultant of all forces of weight is considered to be concentrated.

CENTER OF PRESSURE—An imaginary point where the resultant of all aerodynamics forces of an airfoil is considered to be concentrated.

CHECK LIST—A list, usually carried in the pilot's compartment, of items requiring the airman's attention for various flight operations.

CHECK POINT—In air navigation, a prominent landmark on the ground, either visual or radio, which is used to establish the position of an aircraft in flight.

CENTRIFUGAL FORCE—A force created by revolving a system which tends to pull away from the axis of rotation. More specifically, in a helicopter, the rotating rotor system tends to pull the blades away from the rotor head, causing them to form a flat disc area.

CIRCUIT BREAKER—A device which takes the place of a fuse in breaking an electrical circuit in case of an overload. Most aircraft circuit breakers can be reset by pushing a button, in case the overload was temporary.

COCKPIT—An open space in the fuselage with seats for the pilot and passengers; also used to denote the pilot's compartment in a large aircraft.

COLLECTIVE PITCH CHANGE—A mechanical means of simultaneously increasing or decreasing the pitch of all main rotor blades. This angular change is equal on all main rotor blades.

COMPASS, MAGNETIC—A device for determining the direction of the earth's magnetic field. Subject to local disturbances, the compass will indicate the direction to the north magnetic pole.

CONING—The upward flexing of the rotor blades resulting from the vectorially combined effects of centrifugal force and lift.

CRAB—This term describes a condition of flight whereby a desired ground track is maintained by turning into a crosswind by the amount necessary to correct for drift.

CRUISE CONTROL—The procedure for the operation of an aircraft and its power plants to obtain the maximum efficiency on extended flights.

DENSITY ALTITUDE—Pressure altitude corrected for temperature.

DEVIATION—The error induced in a magnetic compass by steel structure, electrical equipment or similar disturbing factors in the aircraft.

DISC AREA—The area swept by the rotating blades, which is practically a circle, having a radius of one-half the rotor diameter.

DISC LOADING—The ratio of gross weight to disc area (gross weight divided by disc area).

DISSYMMETRY OF LIFT—The unequal lift across a rotor disc that occurs in horizontal flight as a result of the difference in velocity of the air over the advancing half of the disc area, and the air passing over the retreating half of disc area.

DRAG—The force which tends to resist an airfoil's passage through the air. Drag is parallel to the relative wind and varies as the square of the velocity.

DRIFT—Deflection of an aircraft from its intended course by action of the wind.

FLAPPING—The movement of a blade vertically about the horizontal axis. There are several reasons for this action, one being the dissymmetry of lift that exists between the advancing and retreating halves of the disc area during horizontal flight.

FLIGHT PLAN—A detailed outline of a proposed flight usually filed with an FAA Flight Service Station before a cross-country flight.

FUSELAGE—The body to which the wings, landing gear and tail are attached.

GLIDE—Sustained forward flight in which speed is maintained only by the loss of altitude.

GROUND EFFECT—The resultant increase in lift gained by operating near the ground at a hover or at slow airspeeds. The additional lift is gained because of a reduction of rotor induced drag. Rotor induced drag is reduced when operating in ground effect because of a better distribution of airflow (downwash) from the main rotor.

GYROSCOPIC PRECESSION—A characteristic of all rotating bodies. Such bodies will be uniformly displaced 90° in the direction of rotation from where a force is applied.

HOVERING—Maintaining a fixed position in space over a spot on the ground. While hovering, lift equals gross weight.

HOVERING IN GROUND EFFECT—The additional lift gained by hovering at a height above the ground of one rotor diameter or less.

HOVERING OUT OF GROUND EFFECT—The capability to hover at an alitude at which no additional lift is gained from proximity to the ground.

LIFT—The supporting force induced by the dynamic reaction of air against the wing.

LIFT COMPONENT—The sum of the forces acting on a wing, perpendicular to the direction of its motion through the air.

MANEUVER—Any planned motion of an airplane in the air or on the ground.

OVERSHOOT—To fly beyond a designated area or mark.

POWER SETTING—A term used to mean the combination of throttle and collective pitch necessary to produce a predetermined RPM and manifold pressure.

RIGID ROTOR—A rotor whose blades and hob are rigid to the mast, and can feather only, but cannot flap or drag.

SEMI-RIGID ROTOR—A rotor system whose blades are fixed to a hob, but are free to flap and feather.

SIGHT PICTURE—A mechanical means of determining the approach angle to the ground by using a ground feature's position on the bubble of the helicopter.

SLIP—This term describes a condition of flight in a crosswind in which the longitudinal axis of the helicopter is parallel and along the flight path. The pedal opposite the direction of the crosswind is used to maintain heading and the cyclic is placed into the wind to maintain ground track.

TACHOMETER—An instrument which registers in revolutions per minute (RPM) the speed of the engine and the speed of the main rotor.

TAIL ROTOR—All the blades and attachments which make up the torque compensating system.

TAXI—To operate a helicopter under its own power on the ground.

TIP PATH PLANE—The imaginary circular surface formed by a plane passed through the average tip path of the rotor blades.

TORQUE—A force or combination of forces that produce a rotating or twisting motion. In a helicopter, the initiating force (engine) rotates the main rotor system in one direction, and the fuselage tends to rotate in the opposite direction. A helicopter with a single main rotor, driven by a conventional engine, employs a tail rotor to compensate for torque.

TRACKING—A term denoting the satisfactory relationship of the rotor blades to each other under dynamic flight conditions. This relationship is established whenever the blade tips rotate in the same place. The word "tracking" has come to mean also the mechanical procedure used to bring the blades to the above satisfactory flight.

TRANSLATIONAL LIFT—The additional lift gained through airspeed because of increased efficiency of the rotor system. It may be gained when transitioning from a hover into forward flight or when hovering into a headwind. Effective translational lift is reached when the translational lift becomes noticeable to the pilot and the helicopter begins to climb.

USEFUL LOAD—In airplanes, the difference, in pounds, between the empty weight and the maximum authorized gross weight.

VISIBILITY—The greatest horizontal distance which prominent objects on the ground can be seen (used to denote weather conditions).

WIND SHIFT (OR WIND SHIFT LINE)—An abrupt change in the direction or velocity, or both, of the wind. Usually associated with a front.

WIND SOCK—A cloth sleeve, mounted aloft at an airport, to use for estimating wind direction and velocity.

WIND TEE—An indicator for wind or traffic direction at an airport.

YAW—To turn about the vertical axis. An aircraft is said to yaw as the nose turns without the accompanying appropriate bank.

SPECIAL INSTRUCTIONS

During your training at this school, you may be assigned to fly the OH-23 Helicopter or the Hughes TH-55 Helicopter. The airspeeds, altitudes, and power settings used by both trainers have been standardized as much as is practicable. There are instances where some settings are different, such as RPM. The table below will establish the proper settings and procedures for those items that are different.

AIRSPEEDS

OH-23 and TH-55

Cruise	50 knots
Climb and Descend	40 knots
High Cruise	60 knots
Autorotation	45 ~~30~~-50 knots

ENGINE RPM SETTINGS

OH-23—All powered flight will be conducted at 3100 engine RPM ~~with the exception of Maximum Take-Offs (3200)~~.

TH-55—All powered flight will be conducted at 2800 engine RPM with the exception of Maximum Take-Offs (2900).

POWER SETTINGS

(Manifold Pressure)

Hover........ Power necessary to hover at an altitude of three feet into the direction of take-off. using 3200 rpm for OH 23

Take-Off	Hover power.
Climb	Hover power.
Descent and Approach	Power as necessary.
Cruise	Power necessary to cruise in level flight at 50 knots.
High Cruise	Power necessary to cruise in level flight at 60 knots (navigation only).
Maximum Take-Off	2″ above hover power or full throttle, whichever occurs first.

Ground Reconnaissance Engine RPM Settings

OH-23 — 2200 RPM
TH-55 — 1850 RPM

SECTION XII

OH-23D HELICOPTER INITIAL PREFLIGHT INSPECTION

1. PREFLIGHT INSPECTION
   - A. UNTIE MAIN ROTOR
   - B. Cockpit Check:
     - (1) Magneto and master switch OFF
     - (2) Part 12, 13, 14 of Form 2408
     - (3) Lights and fuel pressure leaks
   - C. Fuel and Oil Level
   - D. Pitot tube cover—removed
   - E. Bubble for condition
   - F. Flight Controls and Engine Compartment (Right Side), CHECK:
     - (1) Main Rotor Blade—condition
     - (2) Exterior for obvious damage
     - (3) R.H. cabin door emergency release—security
     - (4) Drain fuel strainer
     - (5) Engine cowling for security
     - (6) Engine and Transmission for oil leaks
     - (7) Control rotor for condition
     - (8) Exposed flight control linkages for security
     - (9) Basic Body for fuel leaks
     - (10) Drain carburetor
   - G. Tail Boom and Tail Rotor, CHECK:
     - (1) Tail rotor drive system for security
     - (2) Tail rotor control cables for security
     - (3) Antennas for condition
     - (4) Tail boom structure for obvious damage
     - (5) Stabilizer for condition and security
     - (6) Tail light for security
     - (7) Tail rotor gear box for oil leaks and security
     - (8) Tail rotor blades for condition

H. Flight Controls and Engine Compartment (Left Side), CHECK:

(1) Basic Body for fuel leaks
(2) Engine transmission for oil leaks
(3) Exposed flight control linkages for condition
(4) Control rotor for condition
(5) Main rotor system for security and condition
(6) Cooling fan for condition and security
(7) Drain fuel sump

NOTE: Any discussion of helicopter starting procedure would be incomplete if it failed to deal with "quick starts". Quick starts occur when the helicopter is started at a throttle setting that would cause the transmission clutch to engage immediately, causing a sudden and very rapid acceleration of the entire driven mechanism of the helicopter. This can cause severe damage to both personnel and material. A quick start may cause misalignment of balanced surfaces, shear drive shafts, strip gears, distort the fuselage and otherwise damage the helicopter to such an extent it will require a complete overhaul. A quick start should be stopped by closing the throttle and shutting off the magneto switch immediately. A helicopter should not be flown after a quick start occurs until it has been thoroughly inspected.

SECONDARY PRE-FLIGHT

(To be used only after Initial Pre-Flight)

1. UNTIE MAIN ROTOR BLADE
2. Magneto and master switch OFF—2408—13
3. Fuel and Oil Quantity
4. Helicopter Exterior—Front
5. Flight Controls and Engine Compartment

(Right Side)

6. Fuel Drains
7. Tail Rotor Drive System

8. Flight Controls and Engine Compartment

(Left Side)

9. Main Rotor System
10. Drain Fuel Sump

OH-23D HELICOPTER COMPLETE PREFLIGHT INSPECTION

1. PREFLIGHT INSPECTION

A. Cockpit Check:

(1) **UNTIE MAIN ROTOR BLADE,** move in the direction of rotation through at least 90° to ascertain aft tail rotor drive shaft bearing movement and to position tail rotor blades horizontally. Visually check under surface and leading edge of main rotor blade for defects. Insure 20 yards clearance (hub to hub).

(2) Remove main rotor tie down block and secure in right cockpit seat belt.

(3) Check magneto and master switch OFF.

(4) Check battery quick disconnect for attachment.

(5) Check parts 12, 13 and 14 of the form 2408. Insert date on parts 12 and 13.

(6) Turn fuel on. Turn master, fuel pump, anti-collision, and running lights switches on. Check for fuel leaks right side, operation of anti-collision and right running light. Walk around rear and check tail light operation. Check for fuel leaks left side and left running light for operation. Turn off all switches.

(7) Check level of fuel and oil, (Eng 8 qts, Txmn 4½ qts.).

(8) Cockpit interior, left side, for security and condition of safety belts and shoulder harness, emergency door release, and electrical junction box for security of cover. Check adjustment of tail rotor control pedals and security of first aid kit. Check collective pitch friction lock off.

(9) Left door plexiglas for cracks, and security of attaching bolts.

(10) Left front skid leg for condition and security and forward spring tube for deflection (maximum allowable permanent set is 0.75 inch and locally deflected 0.15 inch maximum in any one foot length.) Left position light for security of mounting and condition of glass. Check left skid, attachment of forward spring tube to basic body, and under surface of basic body section.

(11) Landing light for condition, security. Remove pitot cover, if present.

(12) Bubble for appearance, cracks, and security of attaching bolts.

(13) Right door plexiglas for cracks, security of attaching bolts.

(14) Cockpit interior, right side, for security and condition of safety belts, emergency door release, security of radio equipment, adjustment of right tail rotor control pedal, installation of C.G. ballast plate, and fire extinguisher. Maximum cabin loading is limited to 600 lbs. Use ballast weight so that the center of gravity limitations are not exceeded.

(15) Right front skid leg for condition and security, right position light for security of mounting and condition of glass, attachment of forward spring tube to basic body, right skid, ground handling wheel, aft skid leg, vertical strut, drag strut, and aft spring tube for deflection.

B. Flight Controls and Engine Compartment (Right Side), CHECK:

(1) Underside of basic body check, right side for cuts, dents, popped rivets, etc. and fuel leaks.

(2) Lower and upper right hand tail boom fittings.

(3) Lower aft right hand engine mount frame fitting.

(4) Electrical junction box on right hand side of en-

gine deck for security of cover, cannon plugs, and proper safetying, and general condition of electrical wiring.

(5) Battery for security, drain plugs, vents open and security of quick disconnect.

(6) Lower forward right hand engine mount frame fitting.

(7) Drain fuel strainer.

(8) Condition and security of ignition harness and evidence of oil leaks in lower engine case.

(9) Starter for security of attachment and condition of wiring.

(10) Right side of engine for general condition. Security and safetying of oil temperature bulb, oil filter, oil pressure adjustment cap. Check for oil leaks around engine case, cylinders and rocker box covers.

(11) Condition and security of engine cooling shroud assembly (right side) and engine cooling shroud access door assembly.

(12) Security of external power receptacle cover.

(13) Condition of lower cyclic bell crank cover.

(14) Cyclic push rods, bell cranks, vibration dampers, link assembly, isolation linkage, upper fire wall bell crank bracket, and transmission bell crank bracket for general condition, security and freedom of movement.

(15) Condition and security of cabin heat duct assembly.

(16) Condition and security of engine air intake duct assembly.

(17) Condition and security of inner and outer engine mounting gimbal assemblies, inner gimbal lord mount, and engine mount strut assembly (right side).

(18) Transmission and transmission oil lines for general condition.

(19) Security and condition of tail rotor drive forward slip joint assembly and slip joint cover.

(20) Carburetor for proper safetying, security of controls, security of attaching bolts, and visually check idle cut-off valve plunger for proper position (should extrude about one-half inch.)

(21) Drain carburetor float chamber and close valve when drained.

C. Tail Boom and Tail Rotor, CHECK:

(1) Tail rotor cable turn-buckles and engine deck pulleys for security.

(2) Aft snubber assembly for excessive wear and deterioration of land mount (maximum allowable separation is 1/16 inch in depth and extending 360°).

(3) Forward tail rotor drive shaft for dents or scratches.

(4) Underside of transition section for skin condition.

(5) Frequency transmitter converter and keyer covers for security.

(6) Forward universal joint.

(7) Cardan joint for security of mounting, safeties, cracks, and excessive radial movement.

(8) Aft universal joint.

(9) Aft tail rotor drive shaft bearings, control cables, and guide bracket for excessive wear and safeties.

(10) Tail boom for skin condition.

(11) Security and condition of tail rotor drive aft slip joint assembly and slip joint cover.

(12) Tail rotor control cable terminal fitting bolts for condition and safety.

(13) Condition and security of tail rotor control aft pulleys, aft pulley bracket, and cable drum.

(14) Horizontal stabilizer, rear position light, and wiring for security.

(15) Tail rotor gear box parting surfaces for oil leaks.

(16) Security of tail rotor gear box to tail boom aft bulk head.

(17) Tail rotor gear box filler and drain plugs for safeties.

(18) General condition, security, and safetying of tail rotor blades, blade balance screws, balance weights, attachments of blade roots, and security of tail rotor hub assembly to tail rotor gear box output shaft.

(19) Outboard tail rotor stop and tail rotor drive shaft cap for safeties.

(20) Tail rotor yoke for freedom of movement and security. Blade balance screws for safetying.

(21) Safetying, wear, and radial freedom of control turnbarrels and rod ends.

(22) Security and safetying of pitch change arm to pitch change rod.

(23) Tail skid strut for security and antenna, if present.

(24) Tail boom for skin condition.

(25) Visually check under surface and leading edge of main rotor blade for defects.

D. Flight Controls and Engine Compartment (Left Side), CHECK:

(1) Upper left hand tail boom fitting.

(2) Lower aft left hand engine mount frame fitting.

(3) Left-hand snubber assembly for excessive wear and deterioration of lord mount (maximum allowable separation is 1/16 inch in depth and extending 360^{o}).

(4) Oil coolers and oil lines for general condition, security, and oil leaks. Oil drain valves closed position.

(5) Condition and security of ignition harness.

(6) Condition and security generator air duct.

(7) Left side of engine for general condition, security, and proper safetying. Check for oil leaks around engine case, cylinders and rocker box covers.

(8) Condition and security of carburetor heated air intake flex duct.

(9) Condition and security of inner gimbal, lord mount, inner and outer engine mounting gimbal, assemblies, and engine mount strut assembly (left side).

(10) Check oil breather for security, (back of transmission). Check Txmn pressure warning switch and temp bulb.

(11) Condition, security, and safetying of collective pitch external push rods, push rod end bearings, upper fire fire wall bracket-link-bell crank assembly, transmission bell crank-bracket assembly.

(12) Condition, security and safetying of collective pitch yoke and ring assembly, upper and lower mast boots for lubricant. Check collective pitch yoke retaining pin for safetying and collective pitch yoke support bracket.

(13) General condition, security, and proper safetying of installation of wobble plate pylon assembly to transmission, wobble plate yoke to pylon, and wobble plate yoke to wobble plate. Check wobble plate bearing security and attachment of wobble plate shield.

(14) Security and safety of wobble plate gimbal sleeve to main rotor mast.

(15) Condition, security, and proper safetying of bolts attaching wobble plate gimbal ring to lower scissor, lower scissor to upper scissors, upper scissors to trunnion bearings, and trunnion bearings to control rotor cuff incidence bracket.

(16) Security of nuts securing base of the control rotor hub trunnion to the studs in main rotor hub.

(17) Radial freedom of control rotor cuff bearings to blade root cuff.

(18) Safetying or retaining bolts connecting control rotor cuff and blade assembly spar tube.

(19) General condition of fabric covering of both control rotor blades.

(20) Main rotor blades for condition and security of

bonded areas and visible damage to spar or skin, and vent holes for obstructions.

(21) Safetying of main rotor tension-torsion bar retention pins.

(22) Main rotor blade incidence arms for security of installation, proper horizontal clearance and visually check paint on top surface of the incidence arms for evidence of contact with main rotor hub.

(23) Security and radial freedom of main rotor blade incidence arm push pull rods.

(24) Proper safetying of four bolts securing ballast assembly to the main rotor hub.

(25) Proper safetying and security of bolts of the ballast assembly and ballast tubes.

(26) Main rotor mast spanner nut for security and two safeties.

(27) Safeties and security of spline drive fitting thrusts nuts located in outboard side of main rotor gimbal ring.

(28) Security, safeties, and radial freedom of special bolts securing main rotor hub to gimbal ring (castellated nuts located on the inboard side of main rotor gimbal ring). Clearance of ears on main rotor hub to gimbal ring should be noted by rocking the main rotor blades up and down.

(29) Condition and security of engine cooling shroud assembly (left side) and engine cooling shroud access door assembly.

(30) Security and safetying of cooling fan to cooling fan gear box fan drive shaft.

(31) Visually check condition of upper and lower cooling fan drive coupling assemblies and check coupling assembly snap rings for proper positioning.

(32) Security of snap rings on transmission fan drive shaft and cooling fan gear box drive shaft.

(33) Check transmission oil lines and filter for security.

(34) Lower forward left hand engine mount frame fitting.

(35) Check collective pitch dual throttle control cable assembly, bungee assembly, and collective pitch throttle linkage for safetying and security.

(36) Move collective pitch through full travel to ascertain freedom of system movement and proper operation of throttle override.

(37) Check aft skid leg, vertical strut, drag strut, and ground handling wheel.

(38) Underside of basic body section (left side) for cuts, dents, popped rivets, and fuel leaks.

(39) Drain fuel sump.

2. OH-23D COCKPIT PROCEDURE

A. Starting and Warm-Up

(1) Check main rotor tie down strap and block for security.

(2) Fasten safety belt. (Caution: Excessive belt extending beyond the buckle may foul the controls. Whenever seats are unoccupied, fasten belts and shoulder harness to prevent fouling controls.) Do not tie in knots.

(3) See that cabin heater is "OFF".

(4) Check all controls for full travel and freedom of movement.

(5) Collective pitch down, throttle closed.

(6) Carburetor heat cold, carburetor air filter in "carb air filter" position.

(7) Fuel shut-off valve "ON".

(8) Check circuit breakers "In". (Day-landing light breaker "Out".)

(9) Fuel pump, radio, master, position lights, magneto, and landing light, anti-collision light, instrument lights "OFF".

(10) Set clock and altimeter.

(11) Ascertain condition and static position of instruments.

(12) Check radio power and FM radio switches "OFF".

(13) Check magneto compass.

(14) Master switch "ON, check generator warning light and other electrically operated instruments (Engine oil temperature, volt ammeter, fuel gauge, cylinder head temperature, carb air temperature, Txmn oil pressure warning light. Check cockpit light "OFF".

(15) Center cyclic stick.

(16) Auxiliary fuel pump "ON", (Fuel pressure gauge will fluctuate until carburetor float chamber and pump fuel strainer bowl have been refilled). After pressure stabilizes, prime engine as necessary by opening and closing throttle (use primer switch in extreme cold weather only).

(17) Ascertain that helicopter is clear of personnel or obstructions prior to starting, and shout, "CLEAR, ROTOR BLADES DISPLACED". (57 models: Pull fuel quantity gauge fuse.) Gloves must be on prior to starting and will remain on during flight.

(18) Keep throttle in the indent, depress starter and after engine has turned over 1 or 2 revolutions, switch ignition to right magneto position. As soon as engine starts, release starter and switch ignition tp "Both" position. Check Txmn oil pressure warning light out.

(19) Leave throttle in indent until tachometer needles are synchronized (needles should not join prior to 700 RPM or after 1600 RPM. If such a condition exists, do not fly the helicopter; improper clutch action is indicated.)

(20) Check oil pressure gauge for proper indication (if engine oil pressure is not indicated within 30 seconds after engine starts, stop engine.)

(21) Warm up the engine at 1650 to 1700 RPM until oil temperature gauge indicates 15° C. mimimum. Then increase RPM 2200 and continue to warm up.

(22) Adjust cyclic trim to center rotor hub around mast.

(23) While engine is warming up, put on helmet, turn on radio, and tune in tower.

(24) Turn auxiliary pump "OFF" and check fuel pressure gauge for proper indication (2-5 lbs. PSI). Turn fuel pump on. (57 models: Insert fuel quantity gauge fuse.)

(25) Check carburetor heat operation and apply heat as required to maintain the carburetor air temperature between 32° and 54° C. (45° C. desired for in-flight operation).

(26) Check ammeter for indication of current and generator warning light "OUT".

(27) Press fuel gauge test switch to test the operation of the fuel quantity gauge. (When pressed, the switch causes the gauge pointer to drop toward zero. When switch is released, the pointer should return to its original position. A system malfunction is indicated if the pointer fails to return to its original position).

(28) Maintain 2200 RPM until cylinder head temperature reaches a minimum of 100° C.

(29) Increase RPM to 3200, set manifold pressure approximately two inches above minimum pitch setting. Accomplish normal magneto check, a drop-off of 200 RPM is permissible if there is no engine roughness. Return collective pitch to full down position maintaining 3200 RPM.

(30) Check tip path plane.

(31) Close throttle quickly to split tachometer needles, simultaneously apply right pedal. While needles are split, make low speed mag check of R and L magnetos and momentarily switch to "OFF" to check proper grounding, depress manifold pressure purge momentarily to drain lines. (Caution: Do not depress in flight).

(32) Check engine idle speed (engine should idle with tachometer needles synchronized between 1650 and 1700 RPM). Return RPM to 2200.

(33) Press to test warning lights and check for proper operation. Check Txmn oil temp with spring loaded toggle switch.

NOTE: Any discussion of helicopter starting procedure would be incomplete if it failed to deal with "quick starts." Quick starts occur when the helicopter is started at a throttle setting that would cause the transmission clutch to engage immediately, causing a sudden and very rapid acceleration of the entire driven mechanism of the helicopter. This can cause severe damage to both personnel and material. A quick start may cause misalignment of balanced surfaces, shear drive shafts, strip gears, distort the fuselage and otherwise damage the helicopter to such an extent it will require a complete overhaul. A quick start should be stopped by closing the throttle and shutting off the magneto switch immediately. A helicopter should not be flown after a quick start occurs until it has been thoroughly inspected.

B. Before Take-Off

(1) Fuel selector full "ON".
(2) Fuel pump "ON".
(3) Carburetor heat as required.
(4) Anti-collision light on.
(5) Magneto switch on "Both".
(6) All engine instruments in green.
(7) Radio transmitter selector on position No. 2.
(8) Aircraft clear.
(9) Lock shoulder harness.

C. Before Landing

(1) Carburetor heat as required.
(2) Control friction "OFF".
(3) Shoulder harness locked.

D. Shut-Down Procedure

(1) Engine RPM 2200.

(2) Adjust cyclic trim to center rotor hub around mast.

(3) Place carburetor heat lever to "COLD" position, anti-collision light off. Auxiliary fuel pump off.

(4) Check magnetos at 3200 RPM. Return collective pitch to full down position maintaining 3200 RPM. Close throttle

to split tachometer needles, simultaneously apply right pedal. Accomplish low speed check and grounding check, with needles split. Check engine idle speed.

(5) Increase to 2200 RPM and place fuel shut-off valve in "OFF" position. When engine stops, turn magneto switch off, refill carburetor and turn all other switches off.

(6) Place fuel shut-off valve on "OFF" position.

(7) Let rotor coast to full stop making no attempt to stop it manually (Exception: When shutdown is to be made in high wind conditions, the cyclic control stick will be moved slightly forward. If it becomes apparent that the main rotor blade could strike the tail rotor shaft, the following procedure may be used to stop the main rotor. Grasp the 5-inch drive tube at either end and exert equal pressure with the hands. Do not push or pull the drive tube when attempting to stop the rotor. Avoid scratching the tube with rings. (beware of catching clothing in rotating elements).

(8) Secure main rotor.

(9) Accomplish "walk around" inspection.

(10) Complete Form 2408, parts 12 and 13, and place in proper location to denote refueling is required.

SECTION XIII

TH-55A HELICOPTER INITIAL PREFLIGHT INSPECTION

1. PREFLIGHT INSPECTION

   A. UNTIE MAIN ROTOR
      (1) Place tie downs under left seat
      (2) Magneto and master switch off

   B. Battery Quick Disconnect

   C. Cockpit Check:
      (1) Parts 12, 13 and 14 of Form 2408
      (2) Lights and fuel quantity guage

   D. Bubble for condition

   E. Pitot tube cover—removed

   F. Air cleaner cover—Security

   G. Exterior Inspection—Left Side—CHECK:
      (1) Cockpit Check (Left Side)
      (2) L.H. Cabin Door—Security
      (3) Fuel Level—Drain Sump
      (4) Drain Fuel Strainer
      (5) Check Rosebud for top cap
      (6) Check Oil Level
      (7) Engine for condition and leaks
      (8) Left skid and strut
      (9) Alternator belt for tension
      (10) Damper 4½ to 5—fluid level

   H. Tail Boom and Tail Rotor, CHECK:
      (1) Align tail rotor drive shaft
      (2) Tail boom and tail boom supports
      (3) Antennas for condition
      (4) Tail Rotor blades for condition
      (5) Tail Rotor gear box for oil level, leaks and security

(6) Tail light for security
(7) Tail Rotor drive shaft alignment
(8) Stabilizer for condition and security

I. Exterior Inspection—Right Side, CHECK:
(1) Tail rotor drive shaft damper
(2) Tail rotor cables for condition and security
(3) Clutch belts (8) for condition and security
(4) Clutch actuator
(5) Transmission oil level—leaks
(6) Main rotor system for security and condition
(7) Engine for condition and leaks
(8) R.H. Cabin door—Security

SECONDARY PRE-FLIGHT TH-55A

(To be used only after Initial Pre-Flight)

1. Switches "OFF"—2408—13
2. Helicopter Exterior—Front
3. Fuel and Oil Quantity—Drain Sump
4. Exterior Inspection (Left Side)
5. Strainer
6. Tail Rotor Drive System
7. Exterior Inspection (Right Side)
8. Transmission
9. Main Rotor System

TH-55A COMPLETE PREFLIGHT PROCEDURES

A. Preflight Inspection

1. Untie main rotor blades and insure 20 yards clearance (hub to hub).

2. Mags and master switch "OFF".

3. Connect battery

B. Cockpit Right Side CHECK:

1. Dash 12, 13 and 14 of 2408 insert date on dash 12 & 13.

2. Mixture full lean.

3. Fule valve on.

4. Battery on, check fuel quantity gauge.

5. Beacon, position lights on, fuel boost on.

6. Check Beacon, position lights for operation. Turn off switches.

7. Check first aid kit, fire extinguisher, for security.

8. Shoulder harness and seat belt for security.

9. Right upper canopy, slat for condition and security.

10. Heater motor, and right door attaching pins.

C. Exterior Inspection Right Side, Front and Left Side

1. Inspect right front strut for inflation 3/8 min, right position light (Green).

2. Right front half of skid and ground handling wheel for locking pin and inflation.

3. Bubble for cracks and security.

4. Pitot tube and front cowl for condition.

5. Air filter safetied and air inlet clear of obstructions.

6. Lower beacon for security and condition.

7. Front cross bar and supports for condition and security.

8. Left ground handling wheel for safety and inflation.

9. Inspect left skid front half, left front strut for inflation 3/8 min, and left position light (Red)

D. Cockpit Left Side CHECK:

1. Left shoulder harness and seat belt for security.

2. Left upper canopy and slat for security.

3. Left door and attaching pins for condition and security.

E. Left Rear Exterior CHECK:

1. Fuel tank for security, quantity and fuel cap for security.

2. Check fuel overflow pan for security.

3. Drain fuel sump.

4. Drain fuel strainer.

5. Check rosebud fitting for top cap.

6. Oil level (6-8 qts.)

7. Drain plug for safety.

8. Left side engine for general condition, oil leaks, chafing wires and lines.

9. Left skid, rear half, left rear strut for inflation 3/8 min.

10. Left drag brace for freedom and alignment.

11. Generator/alternator drive belt for tension.

12. Lower mounting bolts, impeller shroud and six impeller bolts for security and safety.

13. Check fore and aft play in short shaft.

14. Check belt drive pulley strut.

15. Check for radial freedom of lower pulley shaft entension.

14. Landing light for security and condition and rear cross bar for deflection.

15. Inspect V-belt cover for condition and security.

F. Damper Alignment and Fluid Level

1. If dampers align between 4½ to 5, no adjustment is necessary. If necessary to realign the blades, hold the tail rotor blade in direction opposite to normal rotation until stopped by the damper, then gently push main rotor blade in direction of rotation until stopped by damper. Bolts on each damper arm should line up at 4¾ to 5 mark and all blades should be nearly identical. Do not attempt to force the dampers into position by using excessive force.

2. Align the tail rotor drive shaft by aligning the mark on the shaft with the mark on the tail boom.

G. Tail Boom, Tail Rotor and Connecting Controls

1. Tail boom supports and boom left side for condition and security.

2. Aft rotating beacon support for cracks in fiberglass.

3. Antenna and mount for security

4. Left side upper and lower fin for condition

5. T/R gear box attaching bolts for safety and security

6. Tail rotor blade for condition pitch change links, teetering hinge and security of attaching nut.

7. Tail skid for condition and security.

8. T/R gear box for leaks, oil level and plugs for safety.

9. T/R pitch control rod and bell crank for freedom of movement.

10. Check aft inspection cap for tail rotor drive shaft alignment.

11. Aft position light for condition (clear) and security of rivets to stabilizer.

12. Inspect fixed stabilizer for condition and security of attachment (Do not press).

13. Right side upper and lower fin for condition and security.

14. Center inspection cap check tail rotor drive shaft damper assembly block, press with finger to feel contact with shaft.

15. Right tail boom for condition and boom supports for security.

16. Tail rotor, control rod, bell crank, control cables and turn buckles for safety and condition.

17. Inspect clutch actuator position (fully disengage) clutch actuator turn buckle, pulley and cable for condition and security.

18. Inspect clutch belts (8) for condition, idler pulley for freedom and smoothness.

19. Battery for security and condition.

H. Main Transmission and Main Rotor Head

1. Inspect main transmission for leaks, check oil level, safeties on drain and filter plugs and check air vents.

2. All push pull tubes for condition and rod end bearings for freedom.

3. Rotor head for general condition and security of the attaching nuts (avoid dephasing main rotor blades).

4. Main rotor blades for condition (top side and bottom side for cracks, dents, and wrinkles).

I. Right Side Engine, Exterior CHECK:

1. Heater hose and shroud for condition.

2. Oil cooler and lines for condition and security.

3. Right side of engine for condition and leaks, chafing wires and lines.

4. Right rear strut for proper inflation 3/8 min.

5. Right drag brace for freedom and condition and rod ends.

6. Inspect right rear half of skid.

1. COCKPIT PROCEDURE

A. Cockpit Check

(1) Adjust pedals.

(2) Fasten seat belts, shoulder harness and check for positive locking.

(3) Controls for full travel and freedom. (Cyclic should be positioned using fore and aft alignment marks). Set cyclic friction (ONLY ENOUGH TO HOLD CYCLIC IN POSITION).

(4) Throttle closed, collective pitch full down and full friction applied.

(5) Fuses tight.

(6) All switches off.

(7) Fuel valve on.

(8) Mixture full lean.

(9) Engine and flight instruments for static position.

(10) Set altimeter field elevation.

(11) Compass for condition.

(12) Map lights off.

B. Starting Procedure

(1) Battery on and check all electrically operated instruments. NOTE: If fuel pressure gauge indicates a pressure reading, bleed off pressure by putting mixture control lever to the full rich position briefly until needle begins to drop, then return to full lean.

(2) Gear box warning light on.

(3) Fuel low warning light press to test.

(4) RPM governor light on.

(5) Clutch light on and switch in release position.

(6) Fuel boost on, pressure 14 to 30 psi.

(7) Throttle cracked approximately 1/8 inch.

(8) Mag switch both

(9) Prime engine by placing mixture in full rich position from 1 to 3 seconds (OMIT FOR HOT OR FLOODED ENGINE), then return mixture to full lean.

(10) Close throttle. Gloves must be on prior to starting and remain on during flight.

(11) Engage starter, when engine runs, place mixture control lever in full rich position. CAUTION: If engine fails to continue to run, return mixture lever to the full lean position at once or flooding will result.

(12) Stabilize engine RPM 1200 to 1600.

(13) Oil pressure 25 psi within 30 seconds (COLD WEATHER: VISIBLE RISE WITHIN 30 SECONDS).

(14) Generator/Alternator on.

(15) Radio switches on.

(16) Helmet on.

C. Rotor Engagement

(1) Oil pressure stabilized.

(2) Engine RPM 1600 RPM.

(3) Collective down and locked, cyclic and pedals in neutral position.

(4) Visually clear helicopter (call clear). NOTE: Maintain fixed throttle during engagement.

(5) Beacon on.

(6) Place clutch control switch in hold position, observe main rotor, move control switch to engage, watch for rotor movement and return switch to hold, regulate engagement rate by moving switch from engage to HOLD, then back to engage as required. From 3 to 4 times is proper technique. CAUTION: Avoid engine speeds below 1100 RPM.

(7) When needles join, place clutch switch in engage position and close guard.

(8) Clutch warning light out, increase RPM to 1850.

(9) Gear box warning light out.

D. Engine Warmup

(1) Move generator/alternator switch to off, check ammeter for drop, return switch to on position and recheck ammeter for change condition.

(2) Fuel boost pump off. Check fuel pressure 14 to 30 psi and engine continues to run, return pump switch on.

(3) Collective friction as desired and make magneto check at 2900 RPM and 2 inches above static manifold pressure. (2 to 4 seconds) 225 RPM maximum drop with no engine roughness. Do not switch to off.

(4) Lower the collective and split needles to check operation of overrun clutch. NOTE: 1200-1400 engine idle. WARNING: Helicopter should not be flown if needles fail to split.

(5) When needles re-join, return to 1850 RPM.

E. Before Take-Off Check

(1) Fuel pump on.

(2) Mag switch to both

(3) Mixture full rich

(4) Fuel on

(5) Radio and transmitter selector switch to proper position.

(6) Engine instruments in the green arc, with a visible rise on cylinder head temp allowable

(7) All warning lights off (except governor)

(8) RPM governor check

(a) RPM control on 2700 range

(b) Governor on

(c) Slowly increase RPM using twist grip throttle, until governor warning light goes out at approx. 2550 RPM. Governor is now controlling engine RPM and tachometer should read approx. 2700 RPM.

(d) Slowly turn RPM control clockwise toward 2900, stop turning control when engine tachometer indicates 2900 RPM.

(e) With engine at 2900 RPM, manually override governor by decreasing throttle, governor should disengage and warning light go on at no less than 2750 RPM.

(f) Using throttle, manually increase RPM slowly; warning light should go out and governor engage at approximately 2800 RPM; governor should bring engine up to 2900 RPM.

(g) Rotate RPM control to full low position and to high position to determine that full governoring range can be obtained and that no overspeed condition results, CAUTION; if 2900 RPM cannot be obtained, position governor switch to off and DO NOT USE.

(h) If operating properly, reset RPM control to obtain 2900 RPM prior to take-off. NOTE: If RPM governor does not allow regulated 2900 RPM operation, flight may be continued if governor switch is in off position.

(9) Trim selector in proper position.
(10) Door latches fastened.
(11) Unlock friction check tip path plane.
(12) Clear for take-off.

F. SHUTDOWN PROCEDURE

(1) Beacon off.

(2) Place governor RPM control at 2700 split needles with throttle, check light on at 2550.

(3) Governor switch off.

(4) RPM 1850.

(5) Level tip path plane (Cyclic should be positioned using fore and aft alignment marks). Friction controls.

(6) Split needles and move clutch switch to disengage after needles split.

(7) Fuel pump **off.**

(8) Cool to 200° oil temperature and visible drop on cylinder head temperature. NOTE: Rotor RPM below engine RPM before shutdown.

(9) Mixture full lean, mags off.

(10) All switches **off.**

(11) Accomplish "walk-around" post-flight inspection.

(12) Complete 2408.