NAVAL AIR TRAINING COMMAND

NAS CORPUS CHRISTI, TEXAS **CNATRA P-477 (Rev. 01-23)**

FLIGHT TRAINING INSTRUCTION

DAY FAMILIARIZATION HELICOPTER ADVANCED PHASE TH-73A

2023

DEPARTMENT OF THE NAVY
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1. CNATRA P-477 (Rev. 01-23), PAT, "Flight Training Instruction, Day Familiarization, TH-73A" is issued for information, standardization of instruction, and guidance to all flight instructors and student military aviators within the Naval Air Training Command.

2. This publication is an explanatory aid to the Helicopter curriculums and shall be the authority for the execution of all flight procedures and maneuvers herein contained.

3. Recommendations for changes shall be submitted via the electronic Training Change Request (TCR) form located on the CNATRA Web site.

4. CNATRA P-477 (New 04-22) PAT is hereby cancelled and superseded.

A. P. RYBAR
By direction

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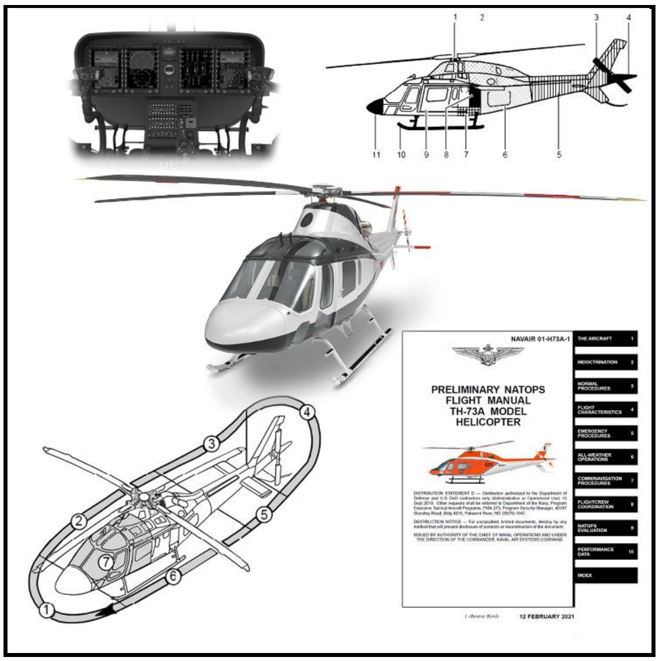
FLIGHT TRAINING INSTRUCTION

FOR

DAY FAMILIARIZATION HELICOPTER ADVANCED PHASE

TH-73A

P-477



LIST OF EFFECTIVE PAGES

Dates of issue for original and changed pages are:
Original…0…06 Apr 22 (this will be the date issued)
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TOTAL NUMBER OF PAGES IN THIS PUBLICATION IS 118 CONSISTING OF THE FOLLOWING:

Page No.	**Change No.**	**Page No.**	**Change No.**
COVER	0	B-1 – B-4	0
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INTERIM CHANGE SUMMARY

The following changes have been previously incorporated into this manual:

CHANGE NUMBER	REMARKS/PURPOSE

The following interim changes have been incorporated into this change/revision:

INTERIM CHANGE NUMBER	REMARKS/PURPOSE	ENTERED BY	DATE

SAFETY/HAZARD AWARENESS NOTICE

This course does not require any special safety precautions other than those normally found on the flight lines.

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CHAPTER ONE
FAMILIARIZATION

100. INTRODUCTION

This chapter serves as the primary guide for familiarization stage maneuvers.

In order for you to learn what you need about flying helicopters, it is necessary to become intimately familiar with this Flight Training Instruction (FTI). The better you understand the academic theory, the easier it is to learn maneuvers in the helicopter. In addition to the FTI, you should consult the following publications:

- TH-73A NATOPS Flight Manual
- Aerodynamics Reference Book
- Rotary-Wing Operating Procedures (RWOP) Manual
- Master Curriculum Guide, TH-73A
- Squadron Standard Operating Procedure (SOP)
- Federal Aviation Administration (FAA) Helicopter Flying Handbook

A thorough working knowledge of procedures is essential for your safe and successful completion of flight training. Go beyond rote memorization and strive to understand the purpose of each maneuver before you get into the cockpit and fly them. The lessons engrained in this stage of training will be core concepts throughout your career in aviation.

101. THE FLIGHT INSTRUCTOR

The roles of the Advanced Rotary Instructor are coach, mentor, copilot, and evaluator. Their objective is to train professional pilots prepared for the needs of the Fleet. Come prepared with exceptional knowledge of your briefing items and procedures. Your Instructor will guide you through the practical application of that knowledge.

102. COCKPIT FAMILIARIZATION

In between events, set aside time to sit in the cockpit and familiarize yourself with the locations of the various instruments and switches. Aircraft are available in the squadron hangar for your use. Coordinate with Aircraft Issue prior to practicing cockpit procedures or the preflight. Simulators and static cockpit trainers are also available for familiarization and checklist practice.

103. PREFLIGHT PREPARATION AND ON-WING

You will meet your On Wing in your first familiarization simulator. Make your initial appearance and each subsequent appearance before an Instructor a good one. Military courtesy and discipline are important factors in your training and will continue to be throughout your military service.

The FAM-0 event provides you the opportunity to demonstrate the preflight, ensure flight gear is sized, and discuss any questions you might have prior to your first aircraft flight.

104. STRESS MANAGEMENT

Much like primary, advanced flight school will be stressful, draining, and challenging. A holistic resilience strategy is crucial to instill, setting the tone early not just for your tenure through flight training but your military career. The following resources are available throughout your career to augment your scheduling and stress management strategy:

- Fleet and Family Support Center
- Chaplain
- Morale, Welfare, and Recreation (MWR)

A proficient officer will familiarize themselves with these resources, not just for their own sake but also for the sake of their fellow Marines, Sailors, and Coastguardsmen.

105. CRM

Pilot error is involved in 50–80 percent of all mishaps in the Navy and Marine Corps. The Navy has instituted the CRM program to educate and train its pilots to prevent such mishaps. Now that you have been designated a multi-crew platform, CRM is a crucial career skill you must internalize and hone every time you fly.

CRM describes the process of coordinated action among crewmembers, which enables them to interact effectively while performing mission tasks. Good CRM can increase mission effectiveness by minimizing preventable crew errors, maximizing crew resources, and optimizing risk management. The Naval Training Systems Center has identified several skills and behaviors that influence CRM. These behaviors have been classified into seven basic areas.

Open CNAF 3710.7 to section 3.8 for information on CRM. The breakdown of the critical behavioral skills you will need to brief and apply can be found in section 3.8.1.

One area to focus on CRM is communicating your maneuvers in the aircraft. Due to spinning rotors, it is imperative that you always understand where your aircraft is in relation to people, aircraft, and items nearby. Expect to visually clear your side of the aircraft before each movement of maneuvers and announce “clear (side of aircraft)” or “hold (and what is the obstacle).” Do not rush this maneuver, and do not assume what you cannot see is clear.

It is also important to communicate what your immediate plans are as the flying pilot. Doing so ensures the entire crew is prepared for the change and can help prevent poor decisions by getting verbal agreement before proceeding.

For example, an SNA may communicate their plans for splitting the field: “The course is 180, so I will circle around the east side of the field and come in to split to the left”.

Another aspect of CRM includes the standard for checklists; the challenge, response, response method shall be used for Engine Pre-Start and Engine Start checklists. For example, the IP will read out, “Pedals and seats, adjusted” from the checklist. The SNA will respond, “Adjusted”.

All other checklists shall use the challenge, response method. For example, the IP will read out “Hydraulic systems”. The SNA will then complete the steps in the check and respond, “Checked”.

1-3 FAMLIARIZATION

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CHAPTER TWO
FUNDAMENTALS OF HELICOPTER CONTROL

200. INTRODUCTION

This chapter reviews the fundamentals of helicopter control. The controls for a helicopter are similar to those in a fixed-wing aircraft. To master the aircraft, the pilot must be thoroughly familiar with how it reacts to control inputs. Smooth control inputs conserve power, promote passenger confidence, and increase mission effectiveness.

Helicopter flying requires no radical change in thought processes. The pilot will find they have more control over the helicopter than over fixed-wing aircraft. In helicopters, large portions of your training will be spent in the region of reverse command, which is referred to in helicopter flying as the back side of the power curve.

This chapter is devoted to a basic explanation of the four separate controls that make up the helicopter control system. NATOPS chapter 2 has more information on the system functionality of the flight control system. The basic helicopter controls consist of the following:

- The cyclic controls the pitch attitude and roll angle of the helicopter.

- The collective acts similar to the throttle in a fixed-wing aircraft; it controls the amount of thrust produced by the main rotor.

- Anti-torque pedals counteract the rotational torque effect of the main rotor to maintain heading control in a hover and balanced flight while in forward motion.

- The twist grip (throttle) has no direct equivalent in fixed-wing aircraft. The twist grip controls fuel flow to the engine and is used for start-up, shutdown, and to set the flight idle and flight positions. The twist grip shall be left in the flight position during flight except when executing power off maneuvers or specifically required when practicing tail rotor and fuel control emergencies.

The following is a discussion of each of these controls and the manner in which they are coordinated to control the helicopter.

201. CYCLIC CONTROL

The cyclic is located directly in front of the pilot and looks like a control stick in the T-6B. The cyclic control is so named because it changes the pitch of the main rotor blades as they cycle past a particular portion of their rotation to control the attitude of the rotor disk about the longitudinal and lateral axis. Rotor response to cyclic inputs is extremely sensitive and rapid in all flight regimes, from zero airspeed to the Never Exceed Speed (Vne). Movement of the cyclic tilts the rotor disk, directing the lift force and giving the pilot complete attitude control. Precise rotor disk attitude control is required to maintain a position in a hover or to maintain airspeed in forward flight. The cyclic offers pitch and roll control in forward flight, much like an airplane control stick; however, it controls the rotor disk directly, not through elevators and ailerons. Angle of Bank (AOB) turns a helicopter in forward flight just as AOB turns an airplane, except there is no adverse aileron yaw.

Some control over altitude can be exercised through the cyclic by trading airspeed for altitude and vice versa; however, this is a secondary function of the cyclic control. Proper handling calls for smooth, precise, and minute corrections more in the nature of pressures than movements.

1. How to Use the Cyclic

Rest the right forearm on your leg and grasp the cyclic grip lightly. Your right forearm must be supported. If there is a natural gap between your forearms and leg, consider using a seat cushion or placing an object under your kneeboard to raise it, and provide an anchor point for your forearm (e.g., an approach plate). Your arm and hand need to be relaxed so that you can apply light, smooth pressure to the cyclic; an anchor point for your forearm will help reduce large control inputs. As in all things rotary, be smooth. Carrying over a general rule from primary, you will put in an initial input and take about half of it out.

WARNING

Do not let go of the cyclic while the rotors are turning—it may result in an undesired aircraft state.

2. Force Trim

The TH-73A incorporates a cyclic force trim system with a magnetic brake and force gradient spring to provide stick position trim and artificial feel. A Force Trim Release (FTR) button is located on the cyclic.

3. How to Trim

Recall the benefits of proper trim use from primary. Trim is adjustment of aerodynamic forces to allow aircraft attitude retention without control input. It allows the pilot to keep the cyclic in a specific position without constant manipulation of controls. When trimmed, the pilot may momentarily release controls, and the aircraft will continue in steady, un-accelerated flight. With proper trimming, pilot workload is reduced so the pilot can focus on other tasks. The fastest way to improve every aspect of flight maneuvering is to use the trim system properly.

When it comes to control inputs, experienced pilots do less. Generally, in any flight profile where the cyclic is trimmed and steady, small corrections should be made around the trimmed neutral position, using it as a reference. If a new attitude is desired or a larger correction is required, the cyclic position should be changed by depressing the FTR.

4. Procedures

a. Press and hold the FTR.

– The magnetic clutch is disengaged, allowing the pilot to move the flight controls without artificial feel or feedback. Avoid over-controlling.

b. Set the cyclic, coordinating pedals and collective and moving controls smoothly to set the new desired rotor attitude.

c. Stabilize, and once set, momentarily pause movement of all controls and scan to ensure the rotor disk is established at the desired attitude.

d. Release the force trim and all pressure from the cyclic and scan to observe aircraft response.

e. Make small corrections around the new trim point using fingertip pressures, or repeat step 1 as necessary.

– When initially learning to trim, after you have released, study the aircraft's performance. Even if the output is not what was intended, observing the results for a moment (as long as it is not unsafe) allows for rapid learning.

5. Common Errors and Safety Notes

The following trim techniques should be avoided:

a. Not depressing the FTR before moderate cyclic movements

i. Moving excessively against the force gradient makes for a tense forearm and slower reaction time. It also results in immediate deviations when the pilot becomes task saturated or distracted.

ii. Moving the cyclic and then depressing the button causes a kick as the pressure is released.

b. Holding down the trim button continuously

i. This is the equivalent of turning off the trim.

ii. This produces over-controlling, pilot-induced oscillations, and immediate deviations when the pilot becomes task-saturated or distracted.

c. Rapidly depressing the force trim button, even in positions where it is not desired

– This will result in erratic neutral force gradient points and force a battle of wills with an inanimate object.

202. COLLECTIVE CONTROL

The collective pitch control is a lever located to the pilot's left and worked by the left hand. It is so named because it controls the pitch of the main rotor blades collectively. Raising the collective moves the entire swashplate assembly up, resulting in an increase in pitch on all four main rotor blades simultaneously.

The primary function of the collective is power control. Though collective blade pitch change is instantaneous, actually accelerating a helicopter in any direction is not.

In addition to lift, the collective controls engine response. Raising the collective increases power required to fly. To match power required with the appropriate level of available power, the collective communicates its position to the engine, and the engine provides power to match. Therefore, the collective is the primary torque pressure control.

Sudden and gross movements of the collective result in drastic changes in torsional forces, which should be avoided. Corrections should be smooth pressures. Little movement of collective is necessary or desirable in normal powered flight. Anchoring your elbow on the side of your seat will ensure you are flying from your forearm and assist in minimizing large power changes.

– How to Use the Collective Pitch Control

Grasp the collective pitch control at the twist grip with a loose yet positive grip. Every collective movement should be slow and smooth so the pedals may be coordinated with it. The collective has a friction adjustment knob at the base to adjust the breakaway friction required to move the collective. This should be set just firm enough to hold the collective at its desired position but not so firm as to make it difficult to move the collective.

The helicopter can be held at a constant altitude in flight by adjusting the collective pitch to a position where the aircraft is neither climbing nor descending. Because this position is determined by the weight of the aircraft, the outside temperature, and many other factors, it will vary from day to day and aircraft to aircraft. Raising the collective will cause the aircraft to climb, and lowering the collective will cause the aircraft to descend.

Collective inputs have secondary effects in all three axes of motion due to changes in torque effect. An increase in collective causes the nose of the helicopter to yaw right, pitch up, and roll right. Conversely, a decrease in collective causes the nose of the aircraft to yaw left, pitch down, and roll left.

WARNING

Do not remove the left hand from the collective in a hover, as it may result in loss of aircraft control.

203. ANTI-TORQUE PEDALS

The pedals are located on the floor of the helicopter and are similar in appearance to the rudder pedals in a conventional aircraft. In a helicopter, however, the anti-torque pedals control the pitch in the tail rotor blades. With the pedals in neutral, the tail rotor is set to have positive pitch to offset torque in stabilized forward flight. Torque applied from the engine turns the main rotor counterclockwise. As a result, an equal and opposite torque force turns the fuselage clockwise (nose to the right). The tail rotor and associated anti-torque pedals are designed to counter this. The heading and balanced flight of the helicopter through changes in torque and airspeed are controlled with the pedals. Pedals are directionally the same as rudders in airplanes, though feel and response rates differ considerably.

Pedals must be coordinated with collective pitch application. Any change of power setting results in a change in the torque force applied to the fuselage. Any change in torque force on the fuselage results in yaw. To prevent unwanted yaw, a matching anti-torque pedal setting must be applied with each collective movement.

Left pedal increases torque. An increase in left pedal pressure results in an increased power requirement (greater lift and drag on the tail rotor), and decreased power requirements result from right pedal application. In the TH-73A, the Fuel Control Unit (FCU) will compensate for the power requirement and maintain constant Revolutions per Minute (RPM). This will be represented in the cockpit by an increase in torque with left pedal input.

There is no adverse yaw in a turn in forward flight; therefore, little pedal is required to make coordinated turns. Excessive use of pedals in turns will cause a noticeable skid. Pedal position required also varies with airspeed as the tail rotor and vertical stabilizer gains efficiency through translational lift.

Good heading control is essential in all flight regimes. In forward flight, proper use of the pedals trims the TH-73A for balanced flight. If the helicopter is flying in a skid or slip at an airspeed sufficient to create noticeable drag, the upwind side of the aircraft will be low, and slow continuous roll oscillations will be noticed. A little pressure on the upwind pedal (low side) will streamline the aircraft for a more efficient and comfortable ride. In terminating any touchdown with forward motion, the pedals are used to parallel the aircraft with the direction of travel so that any ground run will be accomplished with the skids aligned.

In an autorotation, the trim of the aircraft is important because skidding or slipping makes airspeed control difficult and increases Rate of Descent (ROD). Streamlining with pedals offers a considerably longer glide at a slower sink rate. As engine torque is removed from the rotor in autorotation, the tail rotor’s pitch must be decreased by applying right pedal. The aircraft’s proper trim is accomplished by feel initially, and then verifying the pedal setting by consistently scanning the ball. Bank turns the helicopter; the pedals are used to trim the aircraft for balanced flight.

– How to Use the Anti-Torque Pedals

To use the pedals, 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. Let your heels rest on the floor of the helicopter and allow them to slide along the floor if it is necessary to make large pedal movements. The cyclic FTR button will need to be pressed and released to set the new pedal position.

When up collective is applied, you must use the left pedal to keep the helicopter from turning to the right. When collective is reduced, you must use the right pedal to compensate for the loss of torque. This is how the pedals counteract the effects of torque.

204. TWIST GRIP (THROTTLE)

The twist grip is located at the forward end of the collective pitch stick. At the base of the twist grip is an idle detent sleeve. Rolling the grip away from the pilot opens the throttle, and rolling the grip toward the pilot closes the throttle. The idle stop will prevent the pilot from closing the twist grip all the way to the OFF position, thus inducing engine flameout. This feature allows power off practice autorotations without the fear of shutting off the engine inadvertently.

In normal powered flight operations, the engine is governed to maintain a near constant RPM (Power Turbine Speed [N2] and NR) with blade angle changes. Near constant does not mean instantaneous! The pilot may experience lag, droop, or decay.

Lag is the characteristic of the turbine engine occurring briefly when a rapid collective change is made. It is the momentary loss or gain of NR (depending on the direction of collective movement) that occurs until the governor responds and readjusts the fuel flow to stabilize the NR back to its original setting. Lag is a transient NR change only.

Droop describes a change in power turbine speed and rotor speed that occurs with a demand for increased power at a constant speed setting. Droop can be transient or steady state. Steady state droop can occur from an increase in power demand when the engine is already operating at maximum N2 speed.

Decay occurs when the engine can no longer deliver enough power to compensate for a large collective increase. The pilot is literally dragging down NR and could lose lift very rapidly due to NR decay or loss. Small changes in NR can often times be detected audibly, but pilots must know to still visually monitor their engine instruments. Should a decay condition occur in the TH-73A, it is imperative to lower the collective to maintain NR.

CHAPTER THREE
BASIC MANEUVERS

300. INTRODUCTION

This chapter introduces the basic maneuvers learned during day familiarization events. The attitude-flying concept, which was introduced and expanded upon during primary flight training, promotes sound learning habits. Attitude flying is using the flight attitude of the aircraft relative to the horizon and relating the control inputs necessary to achieve changes in the aircraft's attitude. It prepares the Student Naval Aviators (SNA) for instrument flight training and provides for an easy transition into larger, more complex aircraft in an operational aviation unit.

The helicopter in forward flight derives its lift from the engine-driven rotor system and its control from the proper coordination of cyclic, collective, and pedals. There are no maneuvers in this manual that require abrupt or large movements of the controls. Small, relaxed inputs should be used to avoid over controlling. The proper technique to employ is to make small, patient, slow, and smooth corrections to maintain the desired flight attitude.

301. ATTITUDE FLYING

To recap, aircraft attitude is the position of the aircraft in relation to the horizon. Attitude is controlled about three axes: longitudinal (roll), lateral (pitch), and vertical (yaw) (Figure 3-1). Most often, attitude change will include movement about all three axes simultaneously.

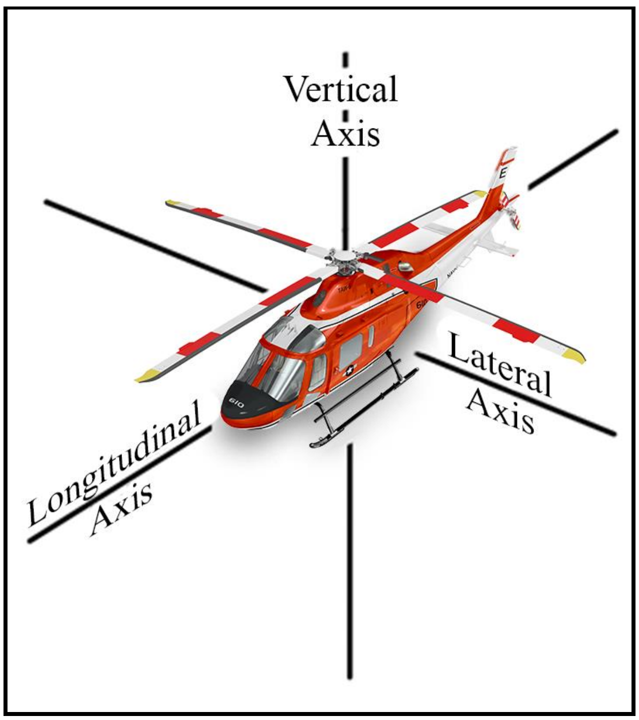


Figure 3-1 Axes About Which Aircraft Attitude Is Controlled

The attitude of the aircraft in relation to the horizon and the power applied are the only two elements of control in all aircraft. Proper use of these two elements of control will produce any desired maneuver within the capability of the aircraft. Therefore, maneuvers are based upon power + attitude = performance.

The outcome of power and attitude inputs is significantly affected by timing and rate of change. With experience and a running awareness of what the aircraft is doing, the aviator can project what the aircraft is going to do based on the power setting and attitude maintained.

302. ATTITUDE CONTROL AND AIRSPEED

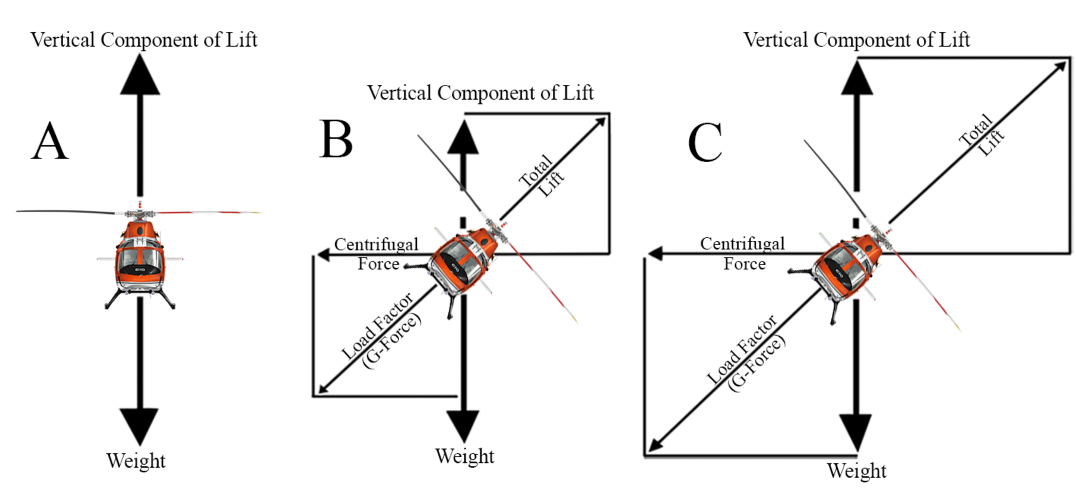
Pitch attitude controls airspeed. To change or maintain airspeed, an aviator sets pitch attitudes for acceleration, deceleration, hover, and sustained cruise airspeeds. Your flight Instructor will demonstrate the sight picture for each.

For a given power setting, there is a pitch attitude that will maintain altitude and airspeed. If power is constant, an increase in airspeed (pitching attitude forward) will produce a descent. Reducing airspeed (pitching aft) with constant power will produce a climb.

Increasing power and maintaining a constant pitch attitude produces a fixed airspeed climb. Reducing power with constant pitch attitude produces a fixed airspeed descent.

303. ATTITUDE CONTROL AND COORDINATED TURNS

To hold a desired heading, the rotor disk is kept laterally level in relation to the horizon. Coordinated turns are accomplished by rolling the aircraft about the longitudinal axis. This tilts part of the vertical lift vector toward the horizontal (Figure 3-2). Rate of turn is controlled by the degree the rotor disk is tilted. Smoothly banking the aircraft to the appropriate degree of lateral tilt is the best way to generate a desired rate of turn.



Lift and Weight are Equal on Aircraft A: Level Flight Ensues

Because Collective Pitch and Power are not Increased on Aircraft B as it Banks to Turn Aircraft Weight is no Longer Offset by the Vertical Component of Lift, and the Aircraft Loses Altitude.

As aircraft C Banks to Turn, Collective Pitch and Power are Increased; Vertical Lift Continues to be Equal to Weight; and the Aircraft Makes a Level Turn.

Figure 3-2 Loss of Vertical Lift During Turns

Stopping a turn takes time and therefore requires anticipation. It is accomplished by beginning a smooth roll of the aircraft to level prior to the desired heading.

Centrifugal force is a heuristic for Newton’s first law that objects will remain in uniform motion in a straight line unless compelled to change by an outside force. A turn produces centrifugal force that moves the aircraft toward the outside of the turn. The resultant load factor is outward and downward.

In a turn with no power change, weight is greater than vertical lift. This causes a descent. Adding power to increase total lift increases vertical lift to match weight. Total lift now counters total load factor, so the aircraft will turn without losing altitude.

Load factor is the total load imposed on an aircraft divided by the weight of the aircraft and is expressed in G units. Airspeed in a turn does not affect load factor but does widen the radius of the turn. For a given bank angle, the rate of turn decreases with an increase in airspeed resulting in no change of centrifugal force.

Load factor during a turn increases exponentially with AOB (Figure 3-3). For a 60-degree bank, the load factor for any aircraft is 2 Gs regardless of airspeed. This means a 6,400-lb aircraft in a 60-degree bank will exert 12,800 lbs of force on the airframe. Bank angles up to 30-degrees produce only moderate increases in load factor, which are acceptable under most flight conditions. High AOBs may produce unacceptable disk loading depending upon the aircraft’s gross weight and flight conditions.

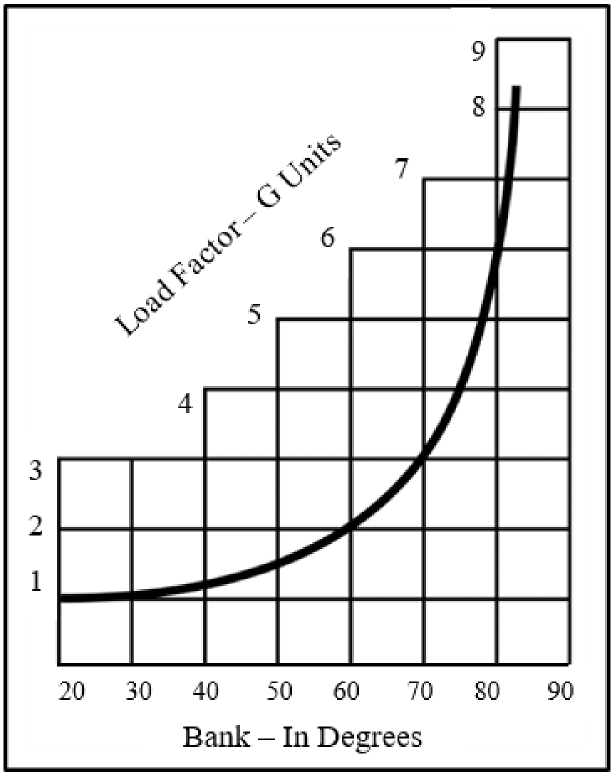


Figure 3-3 Load Factors in Various AOB During Level Turns

304. POWER CONTROL AND RESULTING ALTITUDE, CLIMB, OR DESCENT

When making changes to the aircraft condition, consider using the Power, Attitude, and Trim memory aid. This means leading with power from movement of the collective for desired changes, followed by cyclic input to adjust aircraft attitude, and then setting the trim with the FTR cyclic button (Figure 3-4).

Altitude is a result of power. For a given attitude and airspeed, there is a power setting that will maintain altitude. If a climb is desired with a constant attitude and airspeed, power must be increased above that required to maintain altitude. If a descent is desired with constant attitude and airspeed, power must be reduced below the power required for maintaining altitude.

Power settings for hover, climb, cruise, and descent provide a ballpark collective setting. The pilot must adjust power from these starting points to compensate for variation in atmospheric conditions and aircraft gross weight.

A constant altitude is maintained by stabilizing power and attitude with level Vertical Speed Indicator (VSI). Once the power is set and constant airspeed and altitude are established, any deviation from altitude will cause an airspeed change in the opposite direction. When the altitude is re-stabilized, the airspeed will return to its previous state (provided the power remained the same). If airspeed is high and altitude low, correct with attitude (aft cyclic). Similarly, if airspeed is slow and altitude high, correct with attitude (forward cyclic).

A solid understanding between the relationship between power required and airspeed in a helicopter is important. Vy, best rate of climb airspeed, corresponds with minimum power required airspeed. This is approximately 60 KIAS under most conditions the TH-73 will be operated. It may be found using cruise charts in chapter 21 of the TH-73 NATOPS. Level flight at Vy requires less power than at other airspeeds; more power is required to maintain level flight as airspeed is either increased or decreased away from Vy.

For example, if the helicopter is in straight and level flight at 120 KIAS and aft cyclic is used to slow down to 100 KIAS, the helicopter will climb with no change in torque. If the helicopter is slowed further towards 60 KIAS with the same torque setting, the helicopter will develop a higher rate of climb. Conversely, if the helicopter is in straight and level flight at 60 KIAS and forward cyclic is used to speed up to 100 KIAS, the helicopter will descend with no change in torque. If the helicopter is sped up further towards 120 KIAS, the helicopter will descend at a higher rate.

Name	Function	Primary Effect	Secondary Effect	In Forward Flight	In Hover Flight
Cyclic (Lateral)	Directly Varies Main Rotor Blade Pitch (Left Versus Right)	Creates Left or Right Directional Thrust and Tilted Rotor System	Induces Rolling or Tilting Moment	Turns the Helicopter or Holds Ground Track	Moves Helicopter Sideways
Cyclic (Longitudinal)	Directly Varies Main Rotor Pitch Forward Versus Aft	Creates Forward or Aft Directional Thrust and Tilted Rotor System	Induces Nose-Down or Nose-Up Pitching Action Often Neutralized in Stable Forward Flight by Horizontal Stabilizer Down Force	Controls Altitude or Airspeed	Moves Helicopter Forward or Backward
Collective	Directly Controls Main Rotor Pitch Angle and Angle of Incidence	Increase or Decrease Total Main Rotor Thrust	Increases or Decreases Total Thrust for Altitude and/or Airspeed, Power, and Anti-Torque Requirements	Adjusts or Maintains Altitude and/or Airspeed Settings	Adjusts or Maintains Hover Altitude
Anti-Torque Pedals	Directly Controls Anti-Torque Thrust	Varies Anti-Torque Thrust	Controls Yaw	Maintains Trim for Coordinated Flight	Maintains Heading
Throttle Controls or Power Levers	Maintains Rotor RPM	Affects Power-Plant Output Range	Determines Performance Power Limits of Helicopter	Sets Cruise RPM	Sets Hover RPM

Figure 3-4 Power Control and Resulting Altitude, Climb, or Descent Chart

305. TURBULENCE AND WINDS

Because of the light weight of a training helicopter, it is rather susceptible to turbulence. Vertical oscillations caused by turbulence can range from a slight rocking of the aircraft to a jolting severe enough to damage the helicopter.

Turbulence may cause slight attitude and altitude changes of the helicopter as it moves through the air. Make smooth control movements to maintain altitude and airspeed, but do not try to fight turbulence, as it leads to over controlling.

306. CROSSWIND CORRECTIONS

1. Crab Correction

A crab correction is used to counteract the effect of a crosswind at altitude. Because of the comparatively low velocities of helicopters, large crab (offsets in excess of 20 degrees are common) corrections are often necessary to compensate for crosswinds. Use anti-torque pedals to keep the ball centered, and then roll to an offset heading that produces a ground track towards the desired checkpoint. With a crosswind, the nose should not be pointing in the direction you intend to fly.

2. Wing Down, Top Rudder Crosswind Correction

On final approach, the skids must be aligned with the direction of travel to allow a safe touchdown. When rolling out on final, point the nose toward the intended point of landing, lower the wing (rotor disk) into the crosswind, and use the opposite (top) rudder (pedal) to align the nose with the course line. The ball will not be centered at this point. This is common on final approach in a helicopter, especially at slow speeds on the backside of the power curve.

307. SCAN

Control changes required to produce a given attitude by reference to the horizon in VFR flight are identical to those used in instrument flight, and the pilot’s thought processes are the same.

All maneuvers involve some degree of motion about the lateral (pitch), longitudinal (bank and roll), and vertical (yaw) axes. Attitude control is stressed in terms of pitch, bank, power, and trim control. Instruments are grouped as they relate to control function and aircraft performance as follows:

Power Instruments

- Torque gauge
- Airspeed Indicator (ASI)

Pitch Instruments

- Attitude indicator
- Altimeter
- ASI
- VSI

Bank Instruments

- Attitude indicator
- Radio Magnetic Indicator (RMI)
- Turn rate indicator and ball

During VFR flight, the majority of the pilot's attention is directed outside the cockpit, scanning for attitude in relation to the horizon in addition to traffic lookout and avoidance. Outside reference as well as instruments is used to continuously monitor the helicopter's performance.

Consider the following example: While flying downwind in the pattern, the horizon is maintained at a given level across the windscreen with constant power, airspeed, altitude, and a zero Rate of Climb (ROC) or ROD on the VSI. Due to a slight increase in tension in the pilot's arm, the cyclic control is inadvertently pulled aft. The pitch attitude starts to deviate high, and the windscreen fills with sky, the altimeter shows an increase in altitude, airspeed bleeds off, and the VSI shows a positive ROC. With the integrated scan, the pilot recognizes these changes and eases the cyclic forward to return the nose attitude to its proper relationship to the horizon and all instrument indications back to desired parameters.

308. BODY POSITIONING

Flying a helicopter requires smooth, small, and precise controls and use of both arms and legs. It is easy to become fatigued without proper positioning of the body. Instructors can help ensure you are properly positioned, but there are a few things to consider.

Feet should be against the pedals at all times when flying. Ensure heels are placed on the deck and the top of the feet resting on the pedals. If unable to reach the pedals or the pedals are too close, adjust the pedals with the adjustment knob, and foot position adjustment. Use positive pressure against each pedal to be able to feel feedback and have immediate pressure when needed to maintain heading or adjust yaw to maintain balanced flight.

The left arm should be anchored to the body or aircraft to ensure a consistent feel for its position. Resist the urge to use the shoulder alone as your reference, as this does not allow you to recognize changes in collective and can cause strain over the flight. Instead, make inputs using your forearm from your elbow. When gripping the twist grip and/or collective, keep a positive but light grip, and resist the urge to tightly squeeze the controls.

The right arm should be anchored on the right leg. This isolates the wrist and makes it the only portion of the arm that moves with cyclic control. Small corrections should be made using fingertip pressures only. Ensuring a repeatable neutral cyclic position helps to maintain a stable hover. If unable to rest the arm on the right leg, consider using a sponge or approach plate under a kneeboard to raise the kneeboard and allow a base to stay anchored.

When strapping into the aircraft, proper use of the harness is important for crash survivability, comfort, long-term back health, and the ability to maneuver the body while flying. While flying, it is often necessary to shift the body in the seat to gain a better perspective. It is important that the pilot be correctly fastened into the harness to allow movement and maintain safety. When moving the head or body, it is important to use trim so that involuntary movement of the controls do not cause drift in the direction moved.

309. NORMAL CRUISE

Maneuver Description. Normal cruise is commonly used to fly the aircraft from one point to another. Normal cruise airspeed is 100 KIAS (Figure 4-20).

Application. Normal cruise shall be conducted at a safe altitude and as directed by weather, aircraft configuration, weight, terrain, obstacles, and mission requirements. Power and attitude should be adjusted to attain desired cruise airspeed. Normal cruise is determined from information in part XI of the NATOPS manual.

1. Procedures

    a. Set the proper cruise attitude with cyclic and adjust collective as necessary to maintain altitude and airspeed.

        i. To establish normal cruise, adjust the nose to the cruise attitude with cyclic and trim to maintain airspeed; adjust the collective to maintain altitude.

        ii. The attitude and VSI are the primary scan items you will utilize to maintain 100-KIAS normal cruise and desired altitude.

        iii. Collective torque setting for normal cruise 100 KIAS can be anticipated with cruise performance charts in chapter 21 of NATOPS.

    b. Maintain balanced flight with pedals (ball centered).

Figure 3-5 Normal Cruise

2. Common Errors and Safety Notes

    a. Failure to maintain the cruise attitude

    b. Failure to maintain altitude

    c. Weak scan resulting in large change and erratic power changes

    d. Failure to maintain balanced flight

310. NORMAL CLIMB

Maneuver Description. Climbs are coordinated maneuvers designed to increase altitude.

Application. Climbs are normally accomplished when it is desired to climb from an established altitude to a selected higher altitude.

1. Procedures

    a. Trim to attain the 70-KIAS climb attitude.

    b. At 70 KIAS, adjust collective as necessary to establish a 500–700-fpm climb and simultaneously trim cyclic as required to maintain 70 KIAS.

        i. Maintain balanced flight by simultaneously applying left pedal to counteract torque as the collective is increased.

ii. Torque required for a 500–700-fpm climb at 70 KIAS is roughly the 100-KIAS cruise power setting from chapter20 or part X of NATOPS.

c. At 50 feet prior to the descend altitude, lower the nose to the cruise attitude and accelerate.

– Maintain climb power.

d. Upon reaching cruise airspeed, adjust collective to level off at the desired altitude.

– Maintain balanced flight.

2. Common Errors and Safety Notes

a. Failure to maintain airspeed (attitude)

b. Failure to maintain climb power

c. Failure to make proper level off

d. Improper anti-torque pedal coordination

e. Climbing above desired level-off altitude

f. Failure to scan torque

311. NORMAL DESCENT

Maneuver Description. Descents are coordinated maneuvers designed to decrease altitude during flight.

Application. Descents are normally accomplished when it is desired to descend from an established altitude to a selected lower altitude. A descent is performed a normal cruise airspeed, and collective pitch control is adjusted as required for a desired ROD.

1. Procedures

a. Lower the collective to establish a 500–700-frm ROD.

i. Maintain the cruise attitude in order to maintain airspeed.

ii. Maintain balanced flight by anticipating right pedal as the collective is lowered.

b. At 50 feet above the desired altitude, increase the collective sufficiently to level off the desired altitude.

i. Maintain cruise airspeed and balanced flight.

ii. As the collective is increased, anticipate the need for left pedal.

2. Common Errors and Safety Notes

a. Failure to maintain airspeed

b. Descending below level-off altitude

c. Improper anti-torque pedal coordination

312. FAMILIARIZATION LEVEL SPEED CHANGE

Maneuver Description. A level speed change enables the pilot to transition from one airspeed to another while maintaining a constant altitude and heading.

Application. Level speed changes are frequently utilized to set up for an approach or to transition to another airspeed. While splitting the field to enter the pattern at an OLF, this maneuver will be used to coordinate cyclic and collective inputs.

1. Procedures

a. Establish a 60-KIAS cruise flight at a given altitude at or above 500 feet.

b. Coordinate an addition of power and pedal to accelerate to 120 KIAS.

i. Lead with power. Maintain heading and altitude.

ii. Apply left pedal to compensate for increased torque.

c. Stabilize momentarily at 120 KIAS.

i. Scan the VSI to maintain altitude.

ii. Maintain heading with pedals throughout the maneuver.

d. Coordinate a decrease in power and pedal with back cyclic to accelerate back to 60 KIAS.

i. Maintain altitude with collective and nose attitude. Maintain heading and balanced flight with pedals.

ii. Lead with cyclic forward so as not to balloon and gain altitude.

2. Amplification and Technique

a. This maneuver should be executed smoothly with deliberate changes in power and airspeed.

b. To stabilize at 60 KIAS, set torque for the requisite cruise speed.

3. Common Errors and Safety Notes

a. Improper anti-torque pedal coordination

b. Failure to maintain altitude

c. Rushing the maneuver

d. Failure to maintain balanced flight

e. Failure to anticipate 120 KIAS and to adjust the nose to the 120-KIAS level attitude

f. Slow scan; failure to scan necessary instruments

g. Using large attitude changes instead of small corrections

313. FAMILIARIZATION TURN PATTERN

Maneuver Description. The familiarization stage turn pattern develops the pilot's skill to visually acquire the desired AOB and turn while is simultaneously maintaining airspeed and altitude (Figure 3-6).

Application. The turn pattern is a skills development maneuver that develops the pilot's awareness of visual cues that indicate the AOB, the pitch attitude required to maintained airspeed, and the subtle power changes required to maintain altitude at different AOB.

1. Procedures

a. Establish a 90-KIAS flight at a given altitude at or above 500 feet.

b. Initiate a turn in either direction utilizing 15-degree AOB for 90 degrees of heading change.

i. Approaching 90 degrees of turn, reverse the turn at 15-degree AOB to the original heading.

ii. The reversals will begin at a point prior to the reversal heading.

c. After the second 15-degree AOB turn, reverse the turn and roll into a 30-degree AOB turn for 180 degrees of heading change. Approaching 180 degrees of turn, reverse the turn at 30-degree AOB to the original heading.

– The reversals will begin at a point prior to the reversal headings.

d. After the second 30-degree AOB turn, reverse the turn and roll into a 45-degree AOB turn for 306 degrees of heading change. Approaching 360 degrees of turn reverse the turn at 45-degree AOB to the original heading.

i. Little or no power change is required for the 15 degree AOB turn, but some additional power may be required for the 30-degree AOB turn; usually a definite power increase will be required to maintain altitude for the 45-degree AOB turn.

ii. The reversals will begin at a point prior to the reversal heading.

e. After the second 45-degree AOB turn, roll wings level on heading, altitude, and airspeed.

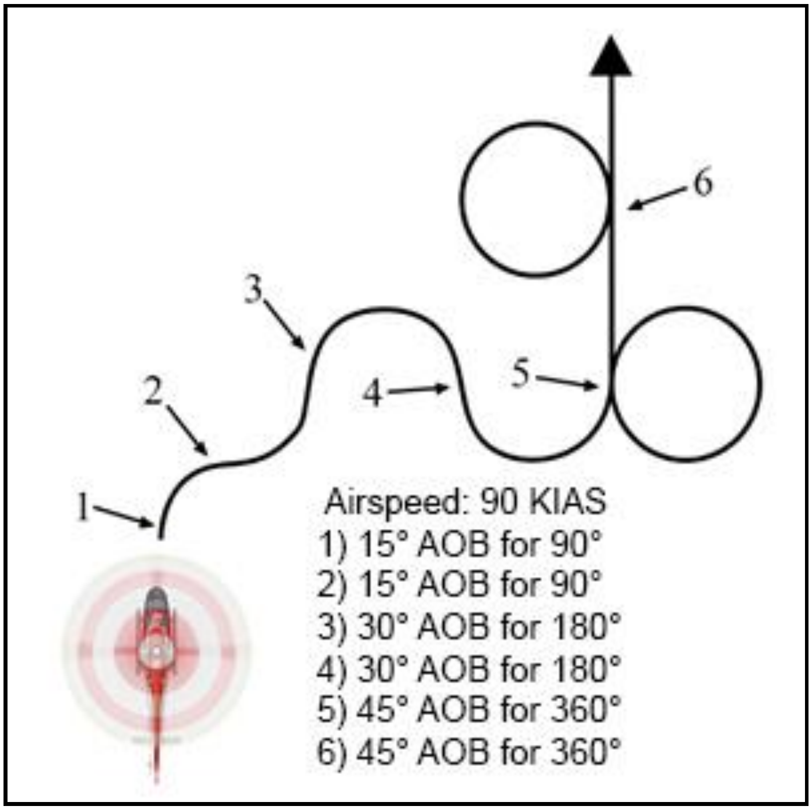


Figure 3-6 Turn Pattern

2. Common Errors and Safety Notes

a. Failure to maintain the proper AOB due to a breakdown in scan and trim techniques

b. Failure to maintain altitude and airspeed because of a need for additional power in the steeper AOB turns

c. Ballooning during reversal due to poor power management and /or scan breakdown

d. Failure to keep ball centered

e. Failure to scan VSI for climb and/or descent trends:

– Avoid the tendency to pull the nose up or allow it to fall during the reversals

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CHAPTER FOUR
LOW WORK MANEUVERS

400. INTRODUCTION

This chapter focuses on the basic low work maneuvers. The hover and scan associated with it are the crux of other maneuvers in this chapter.

The first maneuvers discussed will become second nature as a helicopter pilot. After your first block of flights, these maneuvers will be observed and graded as low work. SNAs will be expected to safely maneuver the helicopter in close proximity to the ground.

401. HOVER

Maneuver Description. Hovering is a maneuver in which the helicopter is maintained in nearly motionless flight over a reference point with constant heading and altitude (Figure 4-1 and Figure 4-2).

Application. Hovering is the unique flight characteristic giving the helicopter its versatility and capability, and the maneuver is used to perform the majority of helicopter missions. Hovering is used to maneuver on air capable ships during Search and Rescue (SAR), anti-submarine warfare, Vertical Replenishment (VERTREP), and some ordnance delivery profiles.

Figure 4-1 Hovering Instrument Cluster

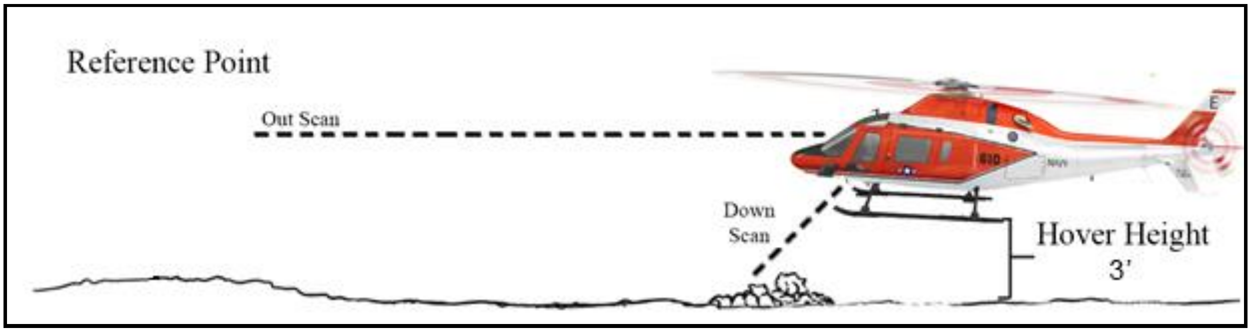

Figure 4-2 Hovering

1. Procedures

    a. Scan out towards the horizon and down to the side to determine reference point.

    b. Use pedals to maintain heading and cyclic to maintain position over reference point.

    c. Use collective to maintain hover altitude of 3 feet.

2. Amplification and Technique

    a. When scanning down, use a defining feature, such as portion of a runway marking, the edge of a landing spot, or even a discolored portion of grass, to maintain position over a known point and correct for drift.

    b. All control corrections should be small pressure changes rather than abrupt movements. The most common error is over controlling. Abrupt and erratic cyclic movements will make a stable hover impossible.

    c. Large cyclic movements to correct drift can cause pilot-induced oscillations. If inducing oscillations, relax cyclic control, ensure proper posture with the controls, and focus on out scan to maintain a stable attitude.

    d. A relatively constant collective (power) setting will enable smoother yaw and cyclic corrections.

    e. A hover altitude of 3 feet (skid height above the ground) is utilized to provide ground clearance and ample tail rotor clearance for maneuvering at hovering and taxiing altitude.

    f. Make timely, small control inputs before the helicopter starts to move from the point.

3. Common Errors and Safety Notes

    a. Over controlling (i.e., larger inputs than necessary)

    b. Allowing excessive nose high attitudes at low altitude, especially with back drift, may cause the tail rotor to impact the ground

4-2 LOW WORK MANEUVERS

c. Fixating through the chin bubble or staring straight ahead rather than scanning out and down

d. Fixating the scan in one place resulting in failure to maintain any of the below:

i. Altitude

ii. Position over a reference point

iii. Heading

e. Being too tense on controls (relax and ensure you are maintaining proper control posture)

f. Undesirable lateral or aft drift

g. Accepting forward drift when unable to maintain position

402. HOVER TAXI OR AIR TAXI

Maneuver Description. Hover taxi is used to describe helicopter movement conducted above the surface and In Ground Effect (IGE) at airspeeds less than approximately 20 Knots Groundspeed (KGS). The actual height may vary, and some helicopters may require hover taxi above 25 feet Above Ground Level (AGL) to reduce ground effect turbulence or provide clearance for cargo sling loads.

Air taxi is used to describe helicopter movement conducted above the surface, but normally not above 100 feet AGL. The aircraft may proceed via either hover taxi or flight at speeds more than 20 Knots Indicated Airspeed (KIAS). The pilot is solely responsible for selecting a safe airspeed and altitude for the operation being conducted.

Application. Hover taxiing is utilized extensively to maneuver the aircraft from one position to another.

1. Procedures

a. Displace the cyclic in the desired direction of movement.

i. Apply cyclic pressure in the direction of travel to begin a slow rate of movement over the ground in the desired direction of movement.

ii. Prior to reaching desired speed, reduce cyclic displacement to ease out the acceleration.

iii. When slowing down, avoid excessive nose up attitudes to maintain tail stinger clearance from the ground.

b. Utilize pedals to maintain heading, cyclic to maintain the desired rate of movement, and collective to maintain altitude.

2. Amplification and Technique

a. In a crosswind, apply lateral cyclic into the wind to maintain ground track.

b. A combination of collective pitch and cyclic governs starting, stopping, and rate of speed while taxiing.

c. Standard taxi signals are depicted in Figure 4-3.

d. Taxi signals are advisory only, except for HOLD, which is mandatory. The pilot is responsible for the safe operation of the helicopter.

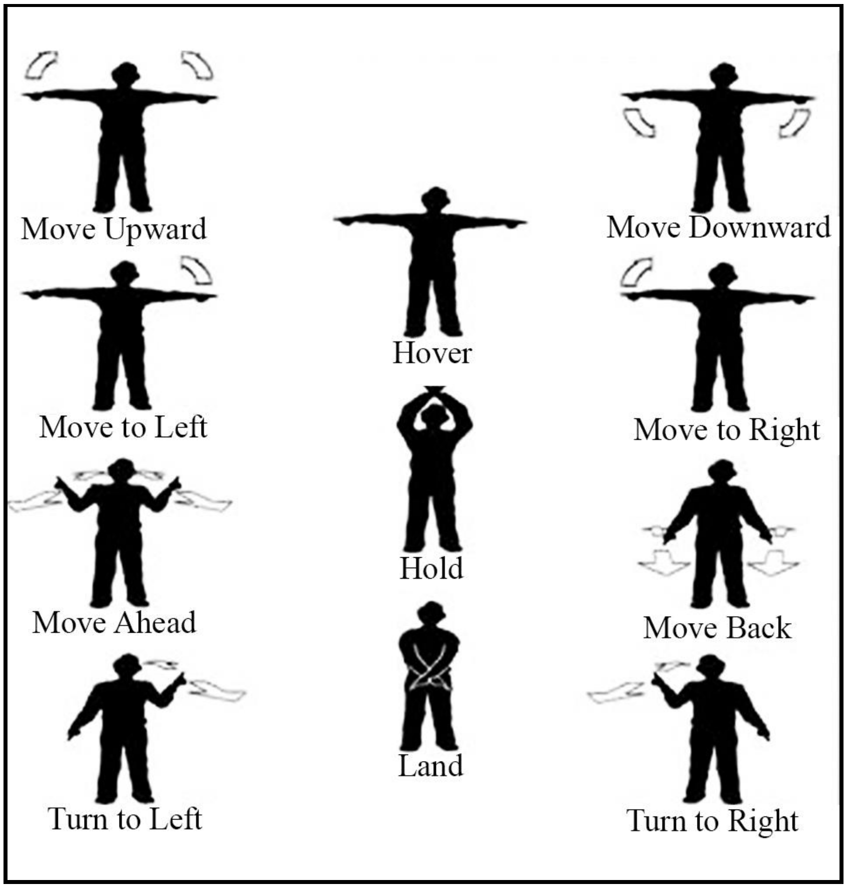

Figure 4-3 Hand Signals

3. Common Errors and Safety Notes

– If the wind across the deck exceeds 25 Knots (kts), turns more than 90 degrees from the wind line should be avoided if possible. Maximum sideward and rearward airspeed is 35 kts. However, the ASI is inaccurate in sideward and rearward flight and airspeed, therefore, must be estimated based on the combined effect of groundspeed and winds.

403. HOVERING TURNS

Maneuver Description. Hovering turns are a maneuver in which the helicopter is rotated about its vertical axis while maintaining a position over a reference point (Figure 4-4).

Application. Hovering turns (also called clearing turns) enable the pilot to clear the area prior to each takeoff, change the direction of taxi, and improve their control coordination.

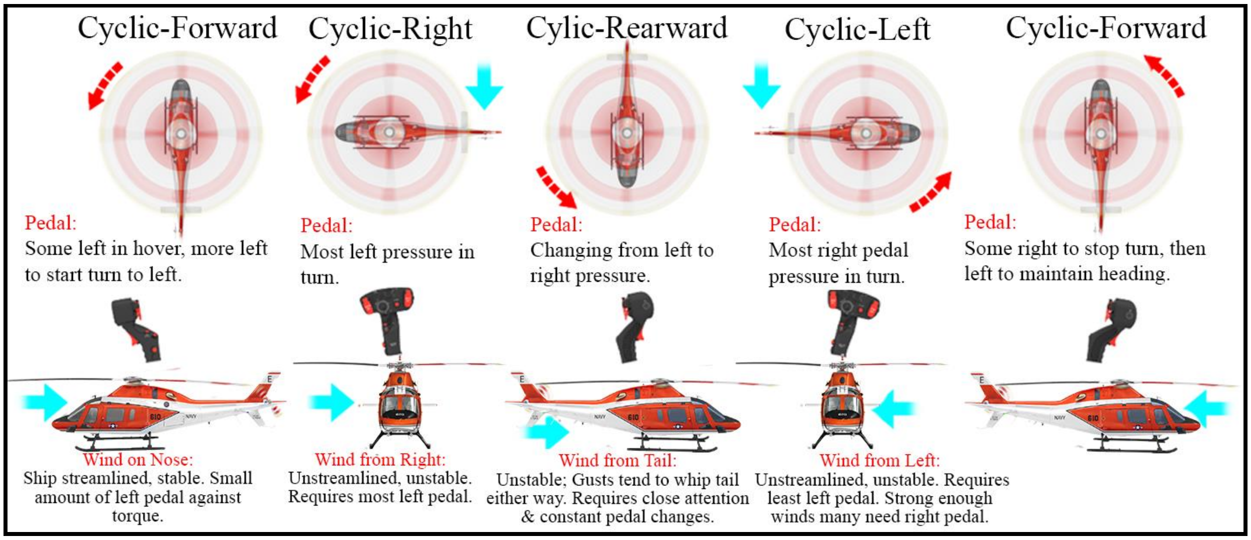

Figure 4-4 Hovering Turn Maneuver

1. Procedures

   a. Begin turn by displacing the appropriate pedal.

   b. As the helicopter turns, adjust the cyclic to remain over the reference point and pedals to control the rate of turn.

      i. Displace the cyclic into the wind. The turn is accomplished with pedals; however, the cyclic needs to be coordinated.

      ii. Coordinate pedals and the cyclic to turn around the mast and keep the tail rotor equidistant from the reference point.

   c. Apply collective as necessary to maintain hover altitude.

2. Amplification and Technique

a. Wind, gusts, and turbulence require consideration. With wind 15 kts off the nose, in order to remain over a selected spot, you must tilt the rotor disk into the wind enough to counter the wind; the aircraft is flying forward at 15 KIAS through the air mass but stationary over the ground. Setting the tail into the wind, the aircraft must fly backwards at 15 KIAS through the air mass to remain at 0 Knots Groundspeed (KGS) over your selected spot (Figure 4-5).

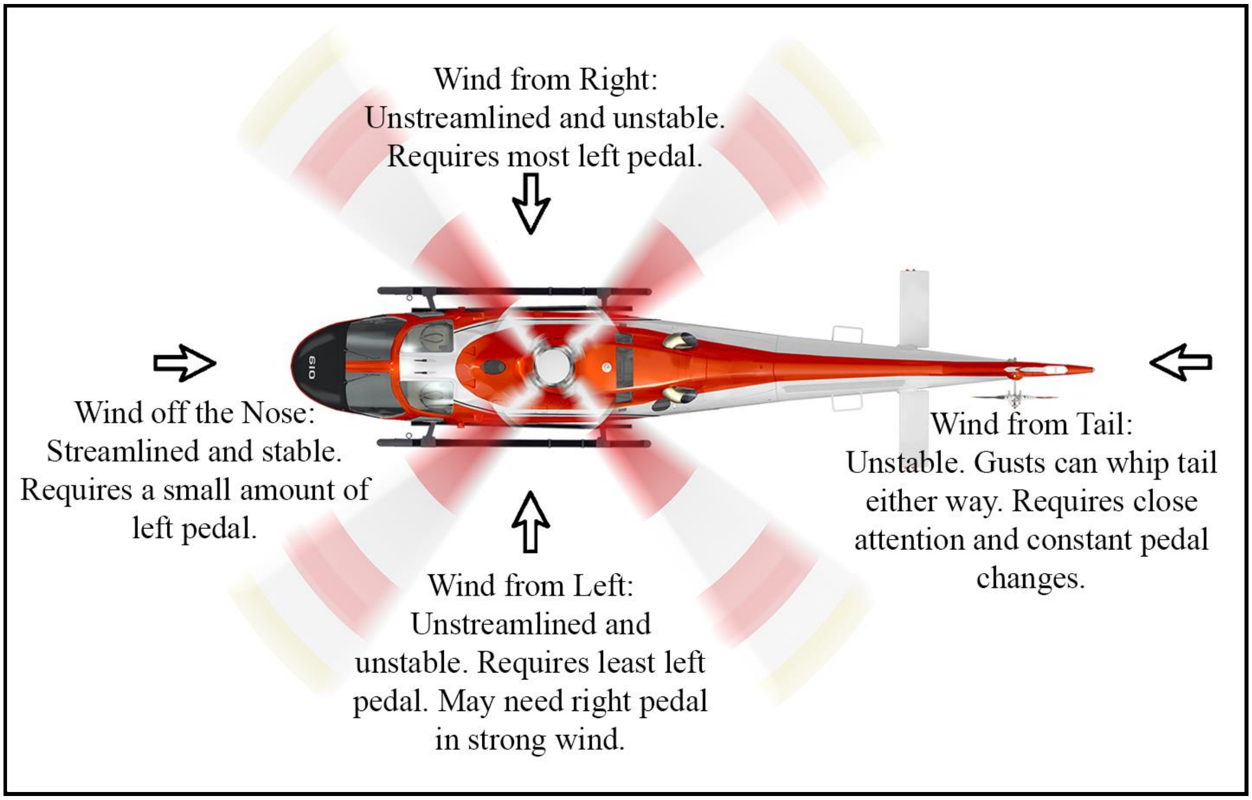

Figure 4-5 Effect of Wind on Rate of Turn

b. The cyclic roughly parallels the lift vector of the rotor. Consider the resultant lift of the main rotor an extension of the cyclic grip. As the aircraft turns, the tilt of the cyclic must trace a small circle at the same rate the aircraft turns, but in the opposite direction to counteract the effects of wind.

c. Compared to the tip path plane, the fuselage will not tilt nearly as much. The horizon may cut through the windshield at roughly the same level all the way around in a hovering turn on a no-wind day. The fuselage will tip nose down appreciably when wind comes from the tail.

d. Direction of turn and rate of turn are controlled directly by the pedals. Use positive pedal pressures on both pedals simultaneously while in the turn, adjusting for winds and ensuring a consistent turn rate.

e. When turning over a spot, turn around the mast. Turning around the mast of the aircraft will ensure that the tail remains the same distance from the point where the turn begins and prevents swinging the tail out while turning.

f. Collective adjustments will be necessary to hold altitude due to varying power requirements from relative wind direction. Additionally, the helicopter tends to climb in left turns and descend in right turns.

g. Remember to look out toward the horizon to control attitude and rate of turn. Make small corrections in rotor attitude, as necessary, to hold position over the ground.

h. Do not rush the maneuver; maintain a consistent turn to prevent stalling, stopping, or whipping around the turn.

NOTE

As the tail of the helicopter passes through the wind line, the rate of turn will increase, and the nose will tend to tuck. Utilize pedals and cyclic as necessary to control the rate of turn and prevent drift.

i. When the wind exceeds 15 kts, avoid turning more than 90 degrees from the wind line if possible.

j. To make a 45-degree clearing turn, stabilize the helicopter completely after finishing a 45-degree turn on the spot left and right of course line. Clear yourself of other traffic.

3. Common Errors and Safety Notes

a. Allowing altitude to change

b. Drifting or ratcheting the rate of turn

c. Excessive rate of turn

d. Rotating about the pilot’s seat instead of rotating about the aircraft’s vertical axis

404. SQUARE PATTERNS

Maneuver Description. Square patterns are precision maneuvers performed at hover altitude using references outside the cockpit.

Application. These maneuvers improve flight control coordination and the pilot’s ability to perform low work operations. These will build scan, basic inputs, and an understanding of wind effects in a hover.

– Procedures

– All square patterns are performed at hover altitude. The starting position is with the cockpit at the middle of the downwind side, with the heading of the helicopter perpendicular to the side of the square.

405. CONSTANT-HEADING SQUARE

– Procedures

a. From the starting position, slide laterally in either direction along the side of the square (Figure 4-6).

i. Maintain the starting position heading throughout the maneuver with pedals.

ii. Clear the aircraft then displace the cyclic in the desired direction to accelerate to a slow, controlled slide.

iii. Prior to reaching desired speed, remove some cyclic displacement to ease out the acceleration.

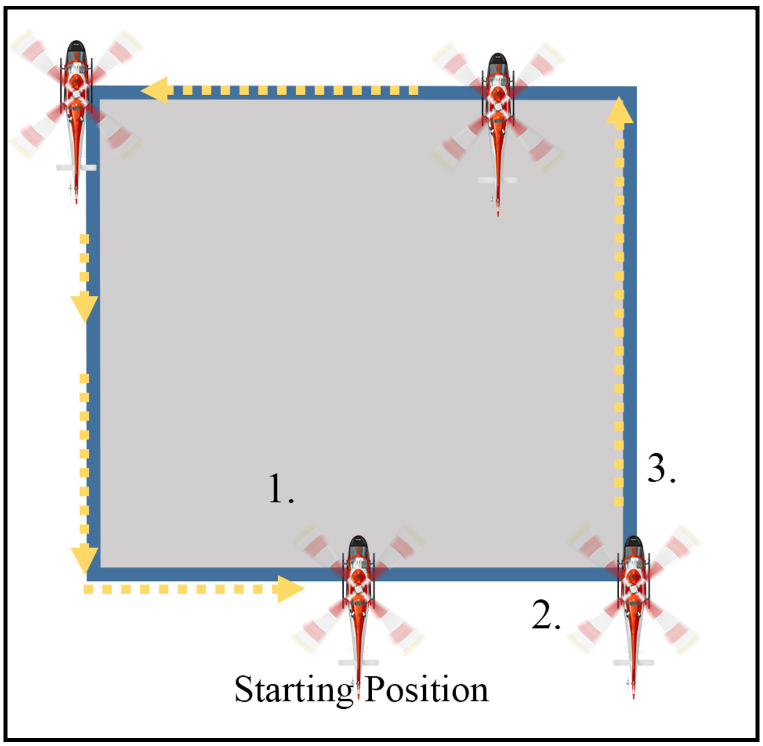

Figure 4-6 Constant-Heading Square

b. Approaching the corner, adjust controls to arrive at a stop. Stabilize the hover over the corner.

   i. Stop at the corner so that the axis of the aircraft is aligned with the next side of the box.

   ii. Decelerations are not instantaneous—they must be anticipated. Increase scan perpendicular to direction of travel prior to the edge of the box to judge deceleration.

c. Continue in the new direction while maintaining heading to the next corner.

   i. Clear the aircraft and commence a slow forward taxi by displacing the cyclic in the new desired direction.

   ii. When moving forward or rearward, the line of the square should be under the aircraft to provide the pilot with a visual reference.

d. Stabilize at each corner and continue to taxi along the perimeter of the square while maintaining constant start position heading.

   – The maneuver is complete when stabilized back at the start position.

406. PARALLEL-HEADING SQUARE

– Procedures

a. From the starting position, pedal turn 90 degrees to the right to place the square along the longitudinal axis.

   i. Clear the aircraft before the pedal turn.

   ii. Depending on wind strength, a new neutral trim position may be required.

b. Begin a forward hover taxi.

   i. Displace the cyclic in the desired direction to accelerate to a slow, controlled taxi.

   ii. Prior to reaching desired speed, remove some cyclic displacement to ease out the acceleration.

c. Approaching the corner, adjust controls to stop and stabilize in a hover.

   – Stop to arrive with the downwind side of the square passing through the pilot's shoulders.

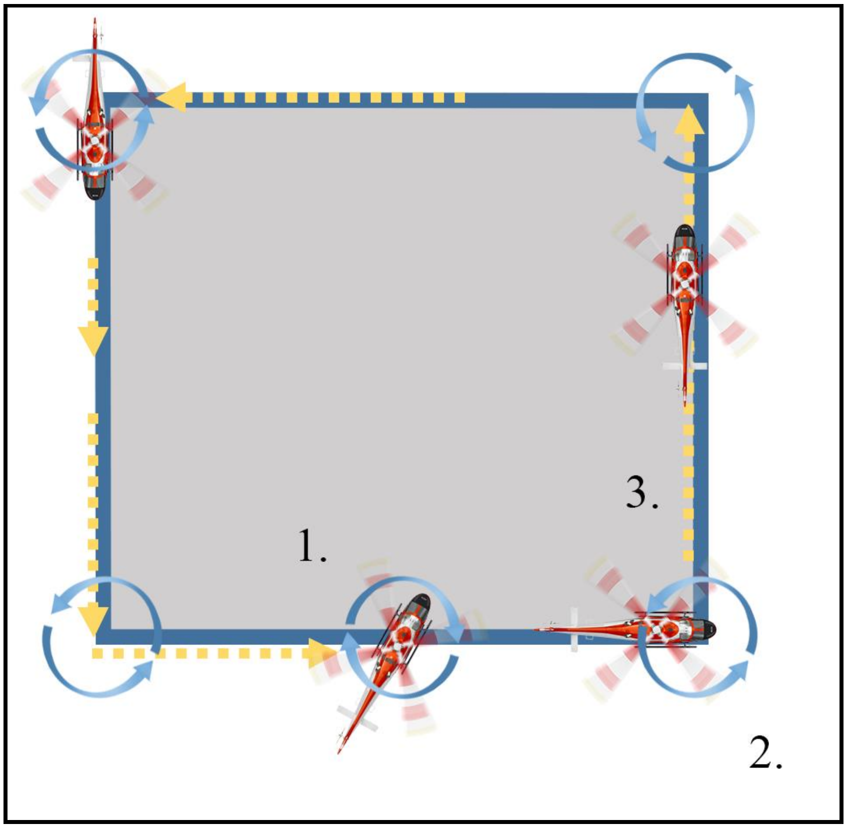

Figure 4-7 Parallel-Heading Square

d. Execute a 90-degree left turn to place the new side beneath the helicopter. Stabilize the hover and continue the air taxi (Figure 4-7).

  i. Pedal turn to align the side of the square under the centerline of the helicopter.

  ii. Repeat this procedure all the way around the square.

e. Continue to taxi along the square, stabilizing, and pedal turning at each corner until returning to the starting position.

f. At the middle of the downwind side, pedal turn 90 degrees left towards the center of the square.

  – The maneuver is complete when stabilized back at the start position and heading.

407. PERPENDICULAR-HEADING SQUARE

1. Procedures

  a. From the starting position, slide laterally in either direction along the side of the square.

i. Maintain the heading perpendicular to the square with pedals throughout the maneuver.

ii. Maintain the line in a consistent position between your seat and your heels.

iii. Clear the aircraft and displace the cyclic in the desired direction to accelerate to a slow, controlled slide.

iv. Prior to reaching desired speed, remove some cyclic displacement to ease out the acceleration.

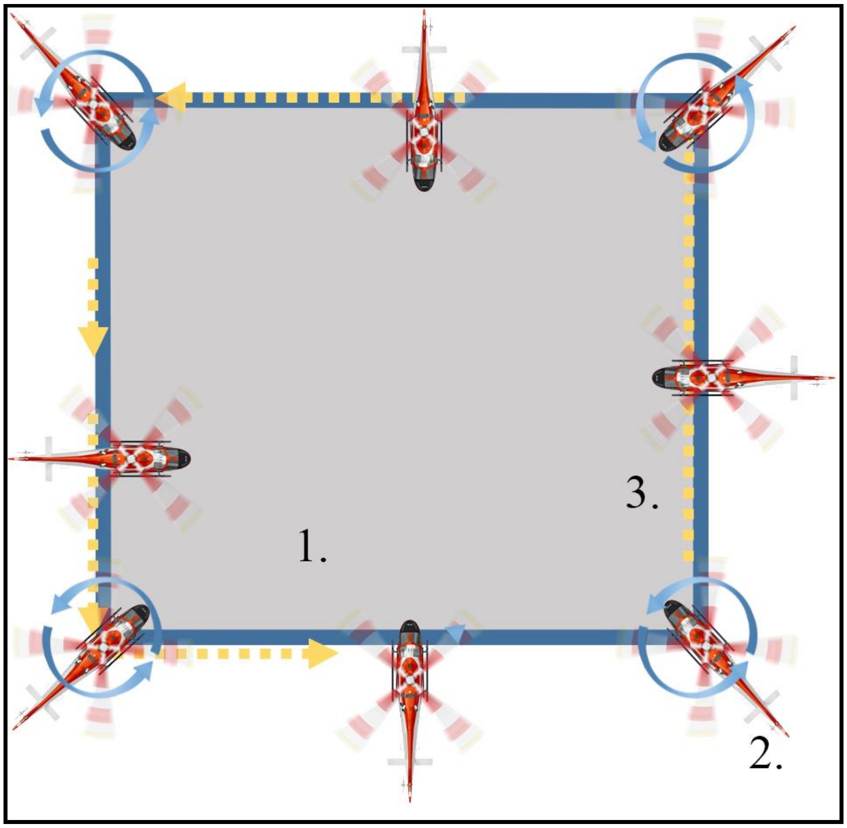

Figure 4-8 Perpendicular-Heading Square

b. Approaching the corner, continue to slide and turn to a heading perpendicular to the next side of the square. Do not stop lateral motion.

– Coordinate pedals and cyclic to commence a turn about the nose. Do not stop the lateral motion.

c. Continue to slide around each corner until coming to a stop at the starting position (Figure 4-8).

– The maneuver is complete when in a stable hover over starting position.

2. Amplification and Technique

   a. As the tail of the helicopter passes through the wind line, the nose will tend to tuck, and the rate of turn will build without proper control response.

   b. Square patterns are precision maneuvers. Make small, smooth, and deliberate corrections.

   c. Scan by cycling through focus points of out and down faster than is natural. Use peripheral vision to maintain position on the square.

   d. Parallel and perpendicular-heading squares shall not be performed in winds exceeding 25 kts.

3. Common Errors and Safety Notes

   a. Taxiing too fast and rushing maneuver

   b. Failure to maintain a constant position relative to the square

   c. Failure to maintain altitude

      – Be aware of the common tendency to get low at the corners during the turn.

   d. Failure to maintain position over corners during turns to parallel the next side during parallel-heading squares

   e. Failure to maintain hover scan (i.e., fixating too close or on the box)

CHAPTER FIVE
LAND PATTERN MANEUVERS

500. INTRODUCTION

This chapter focuses on the landing pattern, including different takeoffs, landings, and approaches to landing. These maneuvers form the foundation of the skills required of a helicopter pilot and build on the skills outlined in the previous chapters.

Procedural knowledge, chair flight, and repetition are what make autorotational flight nearly second nature to the skilled helicopter pilot. A thorough and working knowledge of the procedures, aerodynamic profile, and factors are crucial to the execution of a successful power off maneuver or autorotation.

Power off maneuvers and autorotations will be introduced in a hover, in a hover taxi, and finally in the pattern. Before your first solo, you will be able to fly the aircraft through the transition from powered flight to autorotational flight, maneuver for landing, and execute a safe landing. With sound understanding of the procedures, these maneuvers can become some of the most rewarding maneuvers you will fly. Your ability to successfully complete a practice autorotation will build confidence in your ability to execute a landing in the event engine loss. Challenge yourself to be as smooth on the controls as your Instructor.

501. TAKEOFFS

Due to the flight characteristics of a helicopter, many types of takeoffs are possible. The type of takeoff selected will depend on helicopter gross weight, obstacles, and environmental conditions. Ideally, all takeoffs keep the helicopter out of the avoid area of the Height-Velocity Diagram when possible, or minimize time in the avoid area, in case of an engine failure on takeoff.

502. ABBREVIATED TAKEOFF CHECKLIST

Prior to each takeoff before a maneuver, the crew shall execute the abbreviated takeoff checklist. Recite the following bolded items while checking associate items:

- “Twist grip flight” – Ensure twist grip is in flight position.
- “NR 102 percent” – check NR and N2 are at 102 percent.
- “CAS checked” – Check for caution lights, and if any Crew Alerting System (CAS) cautions are present, announce condition.
- “Fuel pounds” – Check fuel load.
- “Clear left, right, and above” – Clear the aircraft before lifting.

Before conducting any maneuver, ready the aircraft to maneuver by ensuring controls are trimmed in a neutral position and that any local directives are completed before continuing with the maneuver or flight.

503. VERTICAL TAKEOFF

Maneuver Description. A vertical takeoffs enables the pilot to transition from the ground to a 3 foot Hoover In Ground Effect (HIGE) (Figure 5-1).

Application. The vertical takeoff is the most common type of takeoff and should be used whenever possible. A vertical takeoff can be accomplished whenever the helicopter is capable of hovering with the skids five to ten feet above the ground. The helicopter is lifted from the ground, without drift, to a height of approximately 3 feet from the skids to the ground.

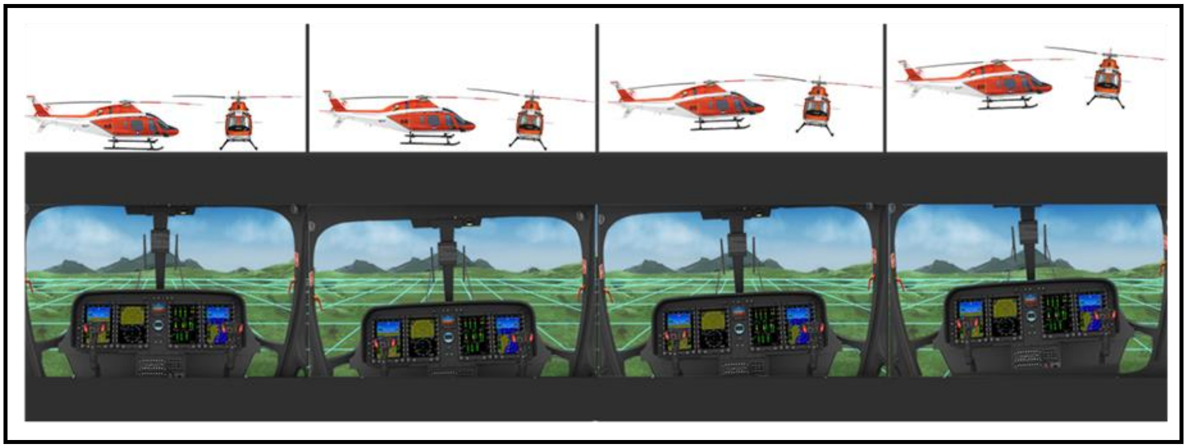

Figure 5-1 Vertical Takeoff

1. Procedures

    a. Raise the collective to leave the ground and continue to a hover altitude.

    – Anticipate right yaw due to increased torque effect, expect to add left pedal to maintain heading.

    (a). Aircraft will lift right skid and toes first, use cyclic to maintain hover attitude.

    (b). Adjust cyclic to maintain hover attitude, hover attitude requires slight back and left cyclic input.

    (c). Maintain heading and position over the ground with a down and out scan.

    (d). A small collective reduction will be needed just prior to hover altitude to slow ROC.

(e). Scanning down or straight ahead degrades fine control of attitude; peripheral vision offers depth perception and detects small movements of the aircraft.

(f). Approaching 3 feet, begin to level off by makings a slight reduction of collective to arrive at three feet.

b. Reaching 3 feet, stabilize and trim out control pressures.

– Use the hover scan to obtain the hover attitude and maintain it.

(a). Trim the aircraft. In a stable hover, the aircraft will be in an approximately five-degree nose high and a three-degree left skid low hover into the wind.

(b). Make small, precise applications of pressures and movements as necessary. Position over the ground is accomplished by making fine attitude changes, not by gross movements.

2. Amplification and Technique

a. Consideration may be given to pressing and holding the FTR button from collective increase until established in a stable hover.

b. Another technique is to use the FTR through the maneuver, re-trimming after the aircraft begins to become light on the skids.

NOTE

In a transition to flight, lift is roughly equal to weight, and the helicopter is very susceptible to wind gusts. Small inputs to keep the aircraft in place may be necessary.

3. Common Errors and Safety Notes

a. Failure to maintain heading, which is usually caused by task-saturation or neglecting out scan.

b. Erratic ascent due to improper collective control applications, which is possibly caused by:

i. Over controlling

ii. Neglecting down scan

iii. Improper collective friction setting

iv. Not anticipating level off

c. Allowing the helicopter to drift, which is possibly caused by:

i. Over controlling

ii. Neglecting portion of scan

iii. Improper use of the FTR button

d. Allowing excessive roll during liftoff

e. Lateral cyclic inputs that do not counter drift leading to dynamic rollover

504. MAXIMUM LOAD TAKEOFF (SIMULATED)

Maneuver Description. The maximum load takeoff optimizes ground effect and translational lift to become airborne when high gross weight or high-DA conditions make a vertical takeoff impossible due to insufficient power to transition to forward flight from a hover. Torque required to maintain a five-foot hover will be used to simulate these conditions and will be the maximum power available for this maneuver (Figure 5-2).

Application. This low-hover profile is designed to minimize power required to attain forward flight. The concepts engrained in this maneuver will enable takeoffs with the largest armament, supply, or survivor load throughout your career. This maneuver is accomplished by flying the aircraft just clear of the surface IGE in order to accelerate to transitional lift. For aircraft with wheels, this is done with a running takeoff down a runway or a smooth and flat surface.

1. Procedures

a. In a 5 foot hover, check hover torque, then land.

– This torque setting simulates the maximum power available for the maneuver.

b. Raise the collective until the aircraft is off the ground, not exceeding hover torque.

– Power required should not yet be equal to maximum simulated power available (torque).

c. Apply forward cyclic to begin forward motion, remaining IGE.

i. Be patient as aircraft moves through translational lift; use slight forward cyclic pressure.

ii. Momentary ground contact of the skids is allowed; however, skids must be aligned with direction of travel.

iii. Remaining low keep the aircraft in maximum ground effect

iv. Too fast an application forward will cause the helicopter to settle to the ground.

d. As the aircraft passes through transitional lift, add power to prevent settling and adjust cyclic to remain IGE.

i. Settling will normally occur and should be anticipated (see ground vortex).

ii. Maintain heading with pedals and ground track with cyclic.

e. When passing through 30 KIAS and 10 feet AGL, adjust to 70-KIAS climb attitude in balanced flight.

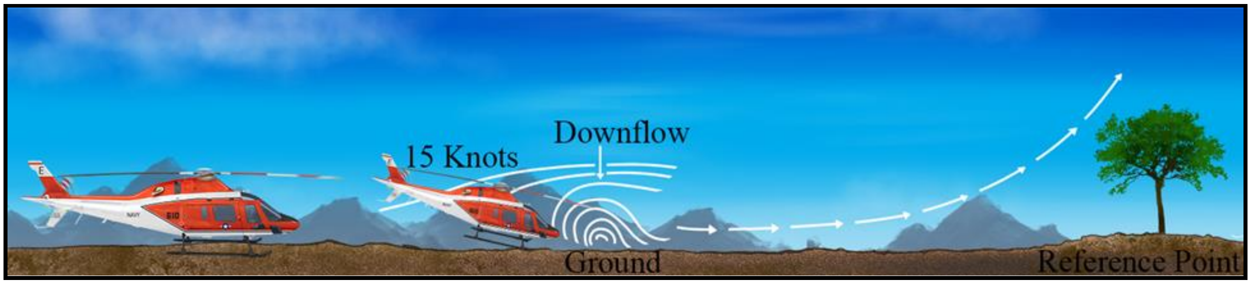

Figure 5-2 Maximum Load Takeoff

2. Amplification and Technique

a. Increase power smoothly to maximum power available and coordinate forward cyclic to remain airborne IGE while accelerating.

b. Do not rush into forward flight.

c. Aircraft will climb due to blowback when accelerating through translational lift.

3. Common Errors and Safety Notes

a. Do not allow the helicopter to settle to the ground unless skids are aligned with direction of travel.

b. Maintain a constant heading during the takeoff. Directional control prevents side slipping, which can lead to dynamic rollover while in ground contact.

c. Not accelerating through translational lift will result in marginal climb and/or acceleration performance.

505. NO HOVER TAKEOFF

Maneuver Description. The no hover takeoff enables the pilot to safely transition from the ground to forward flight while avoiding the dangers of a degraded visual environment (Figure 5-3).

Application. The no hover takeoff is an alternative to the vertical takeoff and normal transition to forward flight. It is employed during degraded visual environments, such as blowing snow, soil, and /or sand, or other particulate matter stirred up by the rotor wash generated by hover flight.

1. Procedures

   a. In a hover, check torque and then land.

      – Select reference point(s) along the intended takeoff path to maintain the desired ground track.

   b. Raise collective to lift (not to exceed hover torque plus 15 percent).

      i. Do not hesitate or stop once the collective pull has started until helicopter leaves the ground.

      ii. Intentional use of the transient range (torque above 108.5 percent) is prohibited.

   c. As the helicopter leaves the ground, apply forward cyclic to begin forward motion.

      i. The rate of forward cyclic application must be slow to prevent an excessive nose-low attitude and aircraft settling when in close proximity to the ground.

      ii. Excessive nose below the horizon will cause descent. Aim for no more than ten degrees below horizon.

      iii. Ensure positive ROC when close to the ground.

      iv. Maintain heading with pedals and anticipate left pedal as power is increased.

   d. Maintain ground track while gaining altitude. At 60 KIAS (maneuver complete), adjust nose to maintain a 70 KIAS climb attitude in balanced flight.

Figure 5-3 No Hover Takeoff

2. Amplification and Technique

   a. Check for any nearby obstructions prior to starting the maneuver.

   b. For training purposes, this maneuver is not intended to be used in a degraded visual environment in the TH-73A.

3. Common Errors and Safety Notes

   a. Failure to maintain a positive and constant collective pull until helicopter has left ground

   b. Failure to maintain heading with pedals

   c. Applying too much forward cyclic and allowing the aircraft to settle

   d. Applying too little forward cyclic and prolonging time in the avoid region of the H-V diagram

506. OBSTACLE CLEARANCE TAKEOFF

Maneuver Description. The obstacle clearance takeoff is a precision maneuver that allows for takeoff in areas where a normal transition to forward flight is unavailable due to terrain obstructions while minimizing the exposure to the avoid area of the H-V diagram.

Application. This vertical takeoff is used when taking off with obstacles prevents a normal takeoff and transition to forward flight. Most often, this would be used in a confined area where maneuvering is restricted. A power check should be conducted before entry into a confined area to ensure power available for departure. For planning, do not exceed 100 percent torque. When simulating an obstacle clearance takeoff, the Instructor will set a simulated height of obstacle to clear.

1. Procedures

   a. In a hover, check torque, and identify optimal takeoff route.

      i. Include a minimum of ten feet of clearance from highest obstruction on the intended flight path.

      ii. If possible, takeoff should be initiated from the downwind portion of the Landing Zone (LZ).

   b. Raise the collective up to hover torque plus 15 percent.

      i. Do not hesitate or stop once the collective pull has started until helicopter is above obstruction.

      ii. Use of takeoff power is permitted if required.

      iii. Do not exceed 108.5 percent torque. Planned use of the transient range is prohibited.

   c. As the helicopter leaves the ground, continue collective pull, maintain vertical profile, and steady position over the ground.

      i. Use a continuous scan around aircraft to prevent and stop drift.

      ii. Maintain heading with pedals and anticipate left pedal as power is increased.

   d. When clearing obstacles, maintain power and apply forward cyclic no more than 5 degrees nose down.

      i. Excessive nose down will cause helicopter to descend unless significantly more power is applied.

      ii. Ensure forward momentum as or before the helicopter is passing obstacles.

      iii. Gain airspeed to reach translational lift as soon as possible while maintaining a safe obstacle clearance.

   e. Accelerate and adjust to 70-KIAS climb attitude in balanced flight.

5-8 LAND PATTERN MANEUVERS

2. Amplification and Technique

    a. Check for any nearby obstructions prior to starting the maneuver.

    b. Maintain collective pull or maximum power until obstruction is cleared.

    c. Consider using the hover mode on the bottom portion of the PFD to augment outside visual scan.

3. Common Errors and Safety Notes

    a. Failure to maintain positioning over ground by drifting towards an obstruction

    b. Failure to maintain continuous collective pull before clearing obstruction to minimize time in the H-V diagram avoid area.

507. TRANSITION TO FORWARD FLIGHT

Maneuver Description. The transition to forward flight enables the pilot to gain airspeed and altitude from a hover (Figure 5-4).

Application. This maneuver enables the pilot to perform a safe transition to forward flight while staying out of the avoid region of the Height-Velocity (H-V) diagram. This affords the pilot the opportunity to safely land the helicopter in case of an engine failure.

1. Procedures

    a. From a hover or hover taxi, apply cyclic to begin forward motion.

        i. At an Outlying Field (OLF), make a clearing turn before forward flight.

        ii. Select two or more points along the intended takeoff path to maintain the desired ground track.

        iii. Too much cyclic will result in a nose-low attitude and a descent.

    b. Passing through translational lift, use the cyclic FTR and increase forward cyclic to maintain less than 10 feet AGL. Avoid exceeding 10 degrees nose down.

        i. Translational lift will occur between 10 and 15 KIAS and will generate a moderate vibration or shudder.

        ii. As the aircraft clears its downwash, blowback will cause the nose to pitch up.

c. Increase collective to prevent settling; accelerate to 30 KIAS below 10 feet.

– As the aircraft settles, add power to maintain altitude. Adding approximately 15 percent torque above hover torque at this point will prevent loss of altitude.

d. Passing through 30 KIAS, add power as necessary to achieve 50 to 60 KIAS by 50 feet AGL.

– Maintain heading in line with the direction of travel, utilize wing down, top rudder crosswind correction if required.

e. Adjust nose to maintain a 70-KIAS climb attitude in balanced flight.

i. Adjust pedals to maintain balanced flight.

ii. A 70 KIAS nose attitude is approximately 5 degrees nose up.

f. Fifty feet below level off altitude, readjust collective and attitude to level off at the required altitude and airspeed.

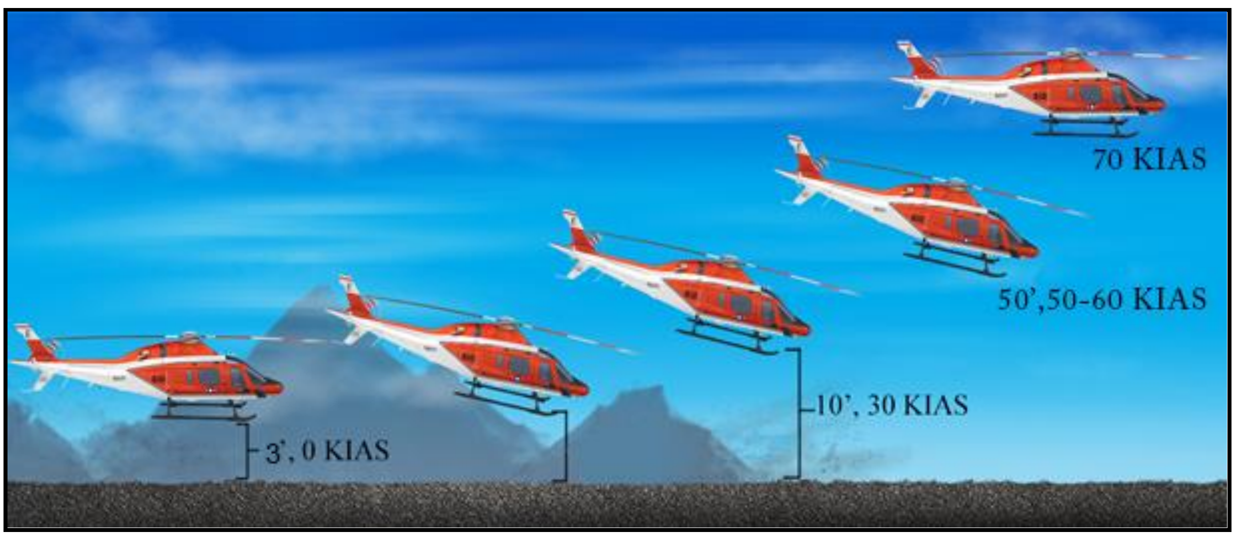

Figure 5-4 Transition to Forward Flight Maneuver

2. Amplification and Technique

a. To accomplish the maneuver, sufficient power to hover must be available and no obstacles can be in the flight path to restrict a normal climb out.

b. A pitch attitude change of approximately 10 degrees from a hover is sufficient to start forward motion. This is usually 5 to 10 degrees nose down, since the helicopter hovers at approximately 5 degrees nose up under most circumstances.

c. Aircraft will tend to climb into the avoid region of H-V diagram without adequate nose down. Ensuring less than 10 feet AGL until reaching 30 KIAS, and 50-60 KIAS by 50 feet AGL will keep the helicopter in the safe region of the H-V diagram.

d. Downwind turns shall normally be executed no earlier than 70 KIAS and 200 feet AGL.

3. Common Errors and Safety Notes

a. Ensuring there is sufficient distance to accomplish a safe, normal takeoff.

b. Rushing the initial takeoff with improper power or too much forward nose.

c. Failing to trim the nose forward to maintain attitude when encountering blowback.

d. Unnecessary increase of collective to start takeoff.

e. Poor heading control.

f. Excessive nose-low attitude on takeoff.

g. Forgetting to check the caution panel and gauges prior to transition to forward flight.

h. Starting the maneuver by increasing collective vice forward cyclic.

i. Excessive nose low, reducing chances for a successful autorotation should engine failure occur on takeoff.

508. ABORTED TAKEOFF MANEUVER

Maneuver Description. The aborted takeoff is a coordinated deceleration of the helicopter while maintaining constant heading and altitude. The maneuver may be terminated in a hover, a hover taxi, a landing, or continue to forward flight for training (Figure 5-5).

Application. This maneuver enables the pilot to develop control coordination needed to rapidly slow the helicopter in situations such as aborting a takeoff following an emergency.

1. Procedures

a. From a hover, begin a transition to forward flight.

– Select two or more points along the intended takeoff path to maintain the desired ground track.

b. Approaching approximately 50 feet AGL and 60 KIAS, level off momentarily to stabilize airspeed and altitude. Maintain heading and ground track with a visual scan.

   i. PNAC should call out altitude and airspeed up to 50 feet and 60 KIAS.

   ii. Maintain the wing down, top rudder crosswind correction as required throughout the maneuver.

c. Coordinate a down collective with aft cyclic to slow the helicopter while maintaining ground track and altitude.

   i. Anticipate leveling off at 50 feet by beginning to smoothly reduce collective approximately 15 feet prior to avoid ballooning.

   ii. Balance pressures so that altitude remains constant. Downward pressure on the collective requires coordinated right pedal to compensate for reduction in torque.

   iii. Ensure NR does not over-speed when lowering the collective. Above 60 KIAS, there is an increased potential of NR over-speed with collective reduction.

   iv. Scan out to horizon to maintain constant altitude.

d. Slow to approximately 30 KGS.

   i. Do not use the ASI to judge groundspeed. Use peripheral vision and scan of the ground to judge groundspeed.

   ii. PNAC should call out groundspeed.

e. Intercept a normal approach profile or recover by coordinating up collective and forward cyclic to accelerate to 60 KIAS at 50 feet AGL.

   – Instructor Pilot (IP) will make and verbalize decision to continue forward or land.

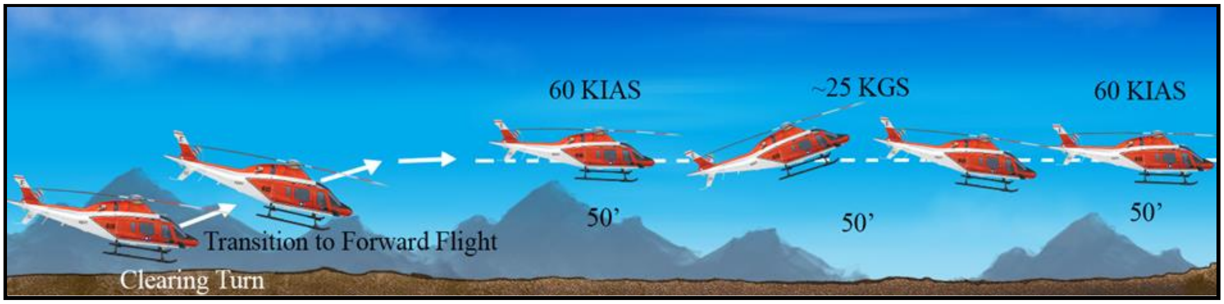

Figure 5-5 Aborted Takeoff

2. Amplification and Techniques

   a. The quality of the maneuver is determined by its relative smoothness and control coordination. Do not rush the maneuver.

   b. Use the height of objects on the horizon to determine and maintain altitude through the maneuver.

3. Common Errors and Safety Notes

   a. Failure to level off at 50 feet and stabilize airspeed at 60 KIAS momentarily

   b. Failure to trim throughout the maneuver

   c. Rushing the maneuver (i.e., climbing during deceleration or acceleration)

   d. Failure to maintain altitude

   e. Failure to decelerate properly

   f. Failure to maintain heading

   g. Failure to resume the transition to forward flight profile after returning to 50 KIAS

509. LANDING APPROACH TYPES

Landing approaches are the procedures used to transition from the landing pattern to a landing. Practicing these approaches will provide the skills necessary for how to fly different glide slopes in preparation for landing. The type of landing approach chosen will depend on the condition the helicopter is operating in. A normal approach is preferred, but may not always be possible under all conditions. A steep approach can aid in landing in more confined spaces, while a shallow approach allows pilots to minimize power changes to aid in landing with a malfunction or emergency.

510. NORMAL APPROACH

Maneuver Description. The normal approach enables the pilot to transition from cruise flight to a hover over a specific point (Figure 5-6).

Application. The normal approach is a transition maneuver, which allows the helicopter to arrive simultaneously at zero groundspeed and hover altitude over a preselected spot with a maximum margin of safety. It is designed to minimize the amount of time spent in a flight envelope where the probability of a safe autorotation is questionable
(as determined in the H-V diagram).

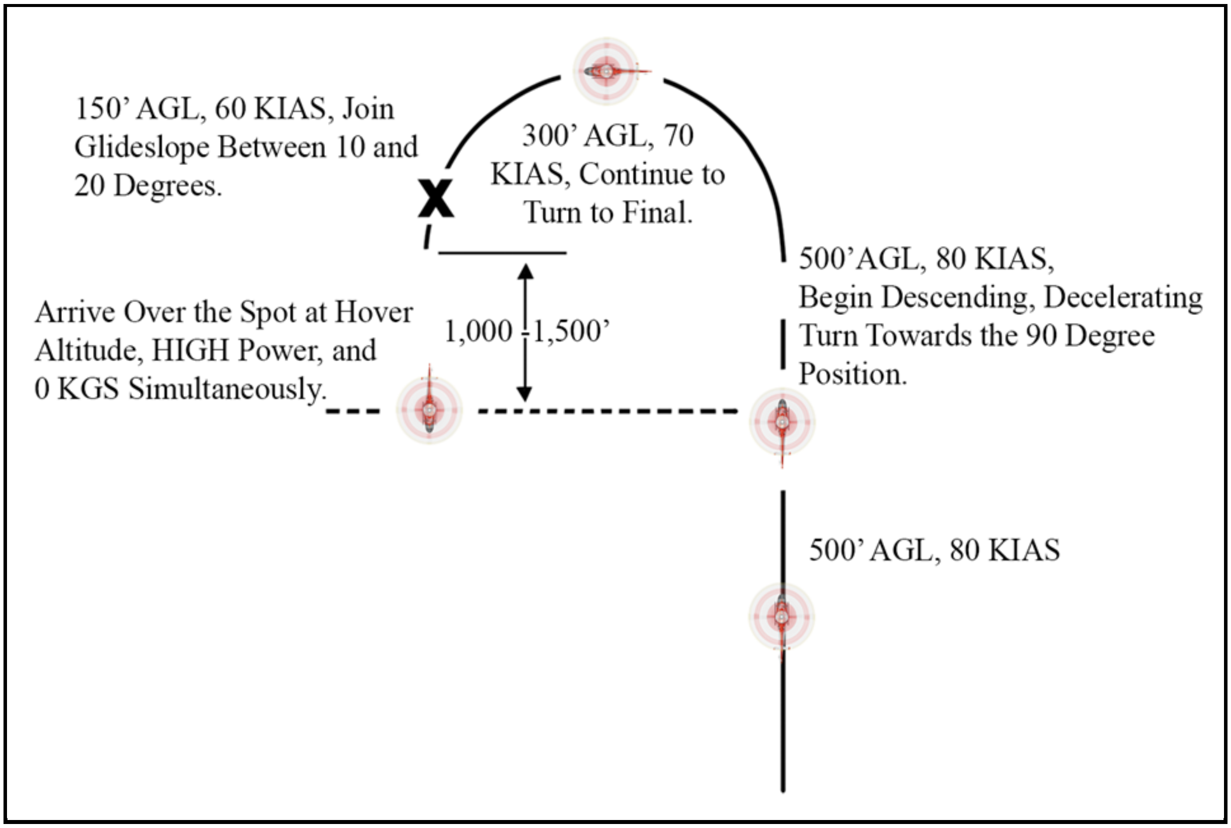

Figure 5-6 Normal Approach

1. Procedures

   a. Maintain 500 feet AGL and 80 KIAS on downwind.

      – Establish the helicopter at the 180-degree position directly abeam the intended point of landing at 80 KIAS and 500 feet AGL.

   b. Abeam the landing location, begin a descending, decelerating turn towards the 90-degree position. Use the following verbal procedures:

      i. "Trim" – Push the FT REL button.

      ii. "Power" – Reduce power to begin a descent.

      iii. "Pedal" – Adjust pedal to keep the aircraft in balanced flight.

      iv. "Pause" – Pause momentarily to check the aircraft is in a 500–700-fpm descent.

      v. "Turn" – Clear the aircraft left and right, and then begin the descending turn.

      vi. "Trim" – Use pedals to center the ball and cyclic trim to maintain attitude. Release the FT REL button.

c. Arrive at the 90-degree position at 300 feet AGL and 70 KIAS, and continue decelerating descending turn to the course line.

i. Adjust the AOB as necessary.

ii. At the 90-degree position, the glideslope and rate of closure visual cues should be acquired.

d. Intercept final at 150 feet AGL and 60 KIAS with sufficient straightway to join the glideslope between 8 and 15 degrees.

– Intercepting glideslope at 150–200 feet AGL and 1,000–1,500 feet of straightaway should provide an 8–15-degree glideslope.

e. Approaching glideslope, set a landing attitude and aim to arrive over the intended point of landing (Figure 5-7).

i. Anticipate the glideslope. An excessively slow collective reduction will result in the helicopter getting steep on the glideslope.

ii. The amount of deceleration required to establish glideslope would vary with wind, Density Altitude (DA), and gross weight of the aircraft.

iii. Upon intercepting the course line, establish a wing down, top rudder crosswind correction as required.

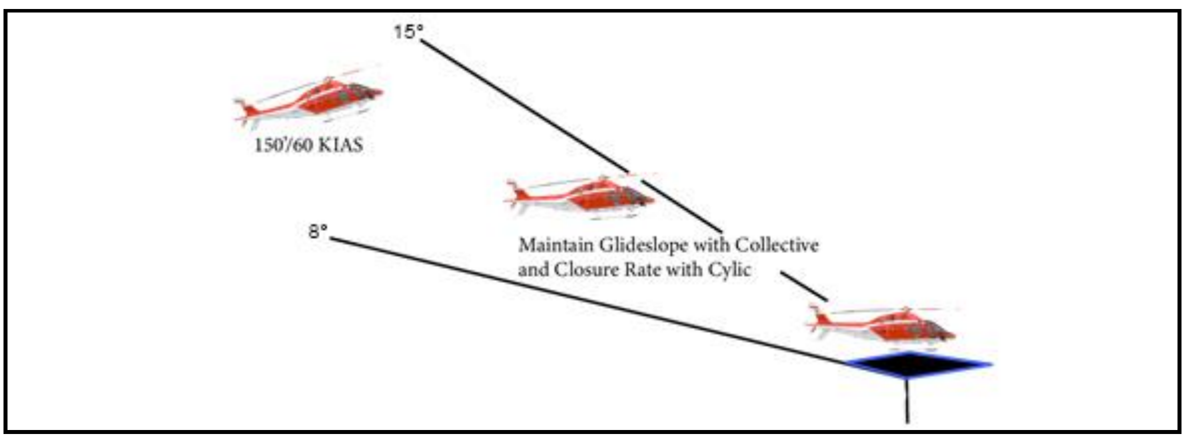

Figure 5-7 Normal Approach Glideslope

2. Amplification and Technique

a. Upon slowing into a hover, be mindful of pendulum effect and use forward cyclic to continue to the intended landing spot.

b. Visualize the proper sight picture by comparing outside reference points to fixed points on the windscreen and/or the instrument panel. Consider a gate at the moment you join the glideslope; attempt to have a repeatable entry to that gate on each approach. Note the relative position of the horizon to the instrument panel.

c. On final, coordinate the cyclic and collective to adjust groundspeed and glideslope. Collective is generally used for adjusting glideslope; cyclic is generally used to adjust groundspeed. The aircraft is flying up the back side of the power curve, so generally collective will need to be increased and cyclic forward to maintain a consistent glideslope to slow from 60 KIAS for landing.

d. Once on final, use a hover scan to pick up closure rates and glideslope to the intended point of landing.

e. Expect noticeably increased vibrations when slowing through translational lift. This increase in vibration is a signal to the pilot that power requirements are increasing at a greater rate. You will need to increase collective and push the cyclic forward at a slightly faster rate to maintain glideslope and closure to the intended point of landing.

3. Common Errors and Safety Notes

a. Do not over control the cyclic.

b. Do not neglect the anti-torque pedals.

c. Make sure to update trim throughout the approach, as the attitude of the aircraft is constantly changing.

d. Maintain only a forward scan when on final.

e. Maintain a constant track from the interception of the course line through termination of the approach, and do not angle to the spot or drift off centerline.

f. Avoid the common error of withholding collective application until the helicopter is close to the intended point of landing. When power is applied abruptly, torque increases rapidly and yaw control is more difficult.

g. Do not allow the helicopter to become excessively nose high above ten-degree nose up a low altitude, as the tail skid may strike the ground.

h. Should any portion of the approach become uncomfortable, initiate a wave-off.

511. SHALLOW APPROACH

Maneuver Description. The shallow approach enables the pilot to transition from cruise flight to a landing with a shallower than normal glideslope, allowing for less power needed close to the ground. This approach allows for smaller power changes and less power required than a normal or steep approach (Figure 5-8).

Application. The shallow approach allows the helicopter to arrive simultaneously with the least amount of power change needed. This maneuver would typically be used in conjunction with an EP, especially one where minimizing power changes and/or power requirements is paramount. Some examples include: engine malfunctions, dual SAS failure, or there is an insufficient power margin to hover.

1. Procedures

   a. Maintain 500 feet AGL and 80 KIAS on downwind.

      – It is important the helicopter be properly established at the 180-degree position directly abeam the intended point of landing at 80 KIAS and 500 feet AGL.

   b. Abeam the landing location, extend five seconds and then begin a descending, decelerating turn towards the extended 90-degree position. Use the following verbal procedures:

      i. “Trim” – Push the FT REL button.

      ii. “Power” – Reduce power to begin a descent.

      iii. “Pedal” – Adjust pedal to keep the aircraft in balanced flight.

      iv. “Pause” – Pause momentarily to check the aircraft is in a 500–700-fpm descent.

      v. “Turn” – Clear the aircraft left and right, and then begin the descending turn.

      vi. “Trim” – Use pedals to center the ball and cyclic trim to maintain attitude. Release the FT REL button.

   c. Adjust the flight controls as necessary at the 90-degree position at 300 feet AGL and 70 KIAS, and continue the descending, decelerating turn to the course line.

      i. Plan for a 90-degree position that is extended from the normal approach to provide a longer final course line.

      ii. At the 90-degree position, the glideslope and rate of closure visual cues should be acquired.

   d. Intercept final with sufficient straightaway at 150 feet AGL and 60 KIAS to maintain a glideslope of 8 degrees or less.

e. Set landing attitude and collective to arrive short of the intended point of landing.

i. The amount of deceleration required to establish glideslope will vary with wind, temperature, and gross weight of the aircraft.

ii. Upon intercepting the course line, establish a wing down, top rudder crosswind correction as required.

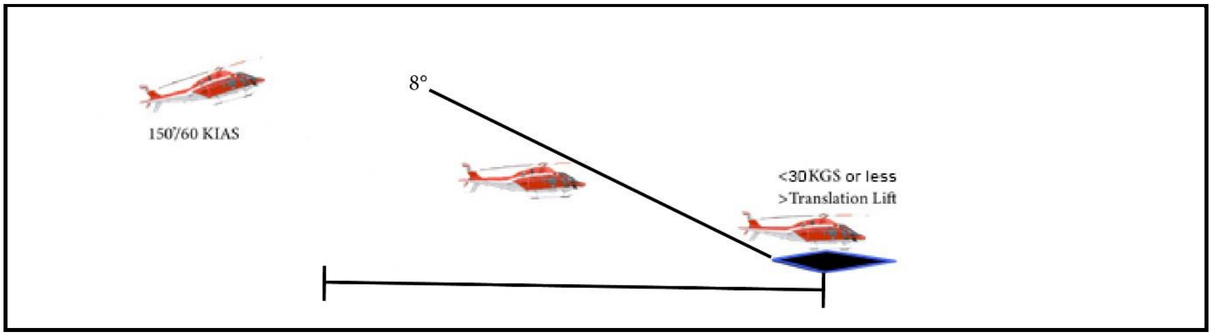

Figure 5-8 Shallow Approach Glideslope

2. Amplification and Technique

a. Visualize the approach pattern while on downwind and determine your ground reference for 90-degree position to allow external reference to pattern checkpoints.

b. Gradual collective application will help prevent yaw excursions when close to the deck.

c. The final approach requires a coordination of the cyclic and collective to adjust groundspeed and glideslope. Collective is generally used for adjusting glideslope; cyclic is generally used to adjust groundspeed.

d. A shallow approach to a sliding landing above translational lift is preferred if power margins are insufficient or the helicopter is experiencing an engine malfunction. In the case of an engine malfunction, such an approach may assist in keeping the helicopter in a safe regime for a powered off landing if the engine were to fail. A recommended profile in this case is to remain at 50 KIAS until below 30 feet AGL.

e. A shallow approach to a hover or landing will aid in minimizing the magnitude of control inputs necessary in case of a control malfunction.

3. Common Errors and Safety Notes

a. Do not over control the cyclic.

b. Do not over control the collective. Failure to keep power changes small will result in larger control inputs with the cyclic and pedals. In an emergency, this may result in loss of aircraft control.

c. Ensure the flight path is clear of obstructions and avoid over flying people, livestock, and buildings at low altitude.

d. Maintain heading with pedals.

e. Ensure to update trim throughout the approach as the attitude of the aircraft is constantly changing.

f. Maintain a constant track from the interception of the course line through termination of the approach, and do not angle to the spot or drift off centerline.

g. Should any portion of the approach become uncomfortable, initiate a wave-off.

512. STEEP APPROACH

Maneuver Description. The steep approach is accomplished at a higher glideslope angle, enabling a pilot to land in a confined area or to clear obstacles along the approach path (Figure 5-9).

Application. The steep approach is a power-controlled approach used when obstacles surround the intended point of landing, preventing a normal approach glideslope. It may also be when a less dynamic, more closely controlled approach is required. The techniques of utilizing power and cyclic coordination to maintain a precision descent will be used again in the confined-area landing.

1. Procedures

   a. Maintain 500 feet and 80 KIAS in the downwind.

   b. Abeam the landing location, extend five seconds and then begin a descending, decelerating turn towards the 90-degree position. Use the following verbal procedures:

      i. “Trim” – Push the FT REL button.

      ii. “Power” – Reduce power to begin a descent.

      iii. “Pedal” – Adjust pedal to keep the aircraft in balanced flight.

      iv. “Pause” – Pause momentarily to check the aircraft is in a 500–700-fpm descent.

      v. “Turn” – Clear the aircraft left and right, and then begin the descending turn.

      vi. “Trim” – Use pedals to center the ball and cyclic trim to maintain attitude. Release the FT REL button.

c. Arrive at the 90-degree position above 300 feet AGL and 70 KIAS. Approaching 300 feet, adjust aft cyclic and increase collective to level off at 300 feet AGL. Continue decelerating turn to arrive on course line at 45 KGS.

d. Intercept a 15–30-degree glideslope final at 300 feet AGL and 45 KGS, and lower collective to join glideslope.

  i. Anticipate joining the glideslope. The amount of deceleration required to establish the helicopter on the glideslope will vary depending on wind conditions.

  ii. Maintain 300 feet AGL until intercepting the 15–30-degree precision approach path.

e. Set a landing attitude and use collective to control ROD.

  i. Use collective to adjust glideslope and use cyclic to adjust groundspeed.

  ii. Avoid rates of descent in excess of 500 fpm with airspeeds less than 30 KIAS.

  iii. Complete the approach to a hover or no hover landing.

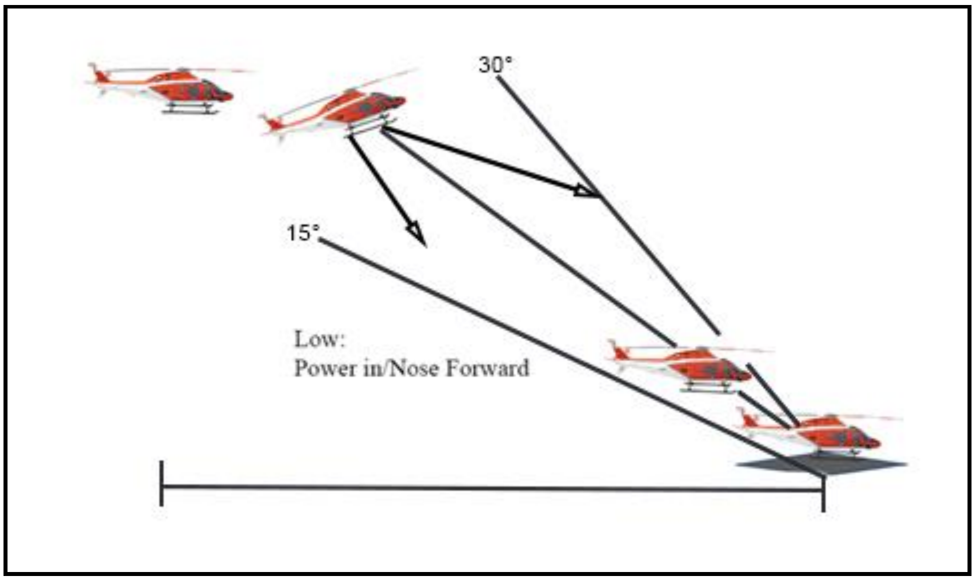

Figure 5-9 Steep Approach Glideslope

2. Amplification and Technique

a. Coordination between the cyclic and the collective is required. The faster you approach the spot (rate of closure), the faster you must descend (ROD). The rate at which the aircraft decelerates directly affects the requirement for collective increase.

b. Power requirements will increase significantly with high ROD or closure close to the ground.

c. Maintain a rate of closure that avoids excessive control inputs to stay on the glideslope. Large control inputs close to the ground are undesirable, unnecessary, and can be dangerous. To avoid this, make any necessary larger inputs early in the approach.

3. Common Errors and Safety Notes

a. Avoid the common error of withholding collective reduction until the helicopter is too close to the intended point of landing.

b. Do not let the helicopter hover on the glideslope prior to the intended point of landing, as the risk of entering the Vortex Ring State (VRS) will be greatly increased. This is often referred to as being hung up on the approach.

c. Do not allow the helicopter to become excessively nose high at low altitudes, as the tail skid may strike the ground.

d. If the glideslope angle or closure becomes excessive, a wave-off shall be initiated.

e. Maintain scan through maneuver and do not focus scan through chin bubble alone.

f. Avoid rates of descent exceeding 500 fpm with less than 30 KIAS as the risk for VRS is greatly increased.

513. LANDINGS

The type of landing selected may be dependent on environmental and helicopter conditions. For example, a hover taken to a vertical landing requires a fair amount of power, while a sliding landing above translational lift requires less power.

514. VERTICAL LANDING

Maneuver Description. A vertical landing enables the pilot to land from a hover.

Application. Land the helicopter by maintaining the hover attitude and smoothly lowering the collective until the skids contact the ground and weight is smoothly transferred from the rotor to the skids. A vertical landing allows the helicopter to operate in areas not available to fixed-wing aircraft.

1. Procedures

a. Over the intended point of landing, lower the collective to begin descent.

– Begin stabilized in a 3-foot hover and heading into the wind.

b. Use pedals to maintain heading and cyclic to eliminate drift.

– Correct to the proper level attitude of the rotor head to prevent drift.

c. As the aircraft touches down, lower the collective to the full down position.

i. Adjust cyclic as necessary to prevent any tendency to drift as the skid gear conforms to the ground plane.

ii. Because of the forward tilt of the transmission, the aircraft may land on the aft portion of the skids first and rotate down to the ground.

iii. Apply anti-torque pedal as necessary to maintain heading.

iv. Do not attempt to lower the collective rapidly after the skids are on the ground. The landing is not complete until the collective is fully down.

NOTE

In a no-wind condition, it will be necessary to displace the cyclic to the left to overcome the anti-torque thrust from the tail rotor and prevent the aircraft from drifting right. Because of this, the helicopter will take off right skid first and land left skid first.

2. Amplification and Technique

a. The pilot should stay as relaxed as possible. Make smooth and timely corrections.

b. Constantly cross check all visual reference points. Hover the helicopter by maintaining a constant attitude. Fly by pressures on the controls and not a movement of the controls (i.e., fly using your fingertips instead of your wrist). A series of small corrections are better than one large correction.

3. Common Errors and Safety Notes

a. Do not over control the collective pitch control. Do not immediately pull up on the collective after lowering.

b. Do not improperly use anti-torque pedals, allowing the nose off the aircraft to yaw.

c. Do not improperly use cyclic control, allowing aircraft to slide over the ground after contact.

d. Avoid landing the helicopter with any drift.

i. Lateral drift on touchdown can lead to dynamic rollover.

ii. Rearward drift can result in tail rotor strike.

iii. Forward drift is not desired.

e. Make sure to maintain the hover scan (i.e., allowing scan to come in too close to the aircraft and staring through the chin bubble).

f. Do not feel for the ground with collective. Remember, every landing should be a surprise.

g. Avoid anticipating the ground contact and lowering collective too quickly, resulting in a firm landing. Remember, if you have done it right, you will barely feel it.

515. NO HOVER LANDING

Maneuver Description. The no hover landing enables the pilot to safely terminate an approach to a landing without transitioning to a hover.

Application. The no hover landing is an alternate termination procedure used in conjunction with the normal and steep approaches. A no hover landing may be used when the landing visibility will be reduced by the rotor wash, where power available is below HIGE or Hover Out of Ground Effect (HOGE), or to rapidly disembark.

1. Procedures

a. Begin with an approach to landing. A normal, shallow, or steep approach profile may be used.

– Approaching ground effect, adjust collective to continue the descent to a landing with little to no groundspeed.

b. Approaching the landing spot, set a controlled closure and ROD on glideslope.

– Trim for touchdown with the landing spot under the center of the aircraft.

c. As the helicopter descends through five feet, increase the out scan to set nonaccelerating attitude and maintain heading.

i. Ensure the nose attitude is below ten degrees above the horizon.

ii. Down scan will still be required to eliminate lateral drift.

iii. Repeat cadence, “Level skids, forward, and down,” three times while in the last ten feet of the approach; this helps ensure a consistent touchdown rate.

d. Adjust power to touchdown with 0–5 KGS.

   i. Ensure skids are level, and the aircraft is coming forward and down all the way until touchdown, not to a low hover.

   ii. The helicopter should touchdown with back skids touching first.

   iii. Power may need to be adjusted slightly up or down depending on conditions.

   iv. Anticipate left pedal as power is applied and adjust cyclic as necessary to eliminate any lateral drift.

2. Amplification and Technique

   – This maneuver can be completed following either a normal approach or steep approach.

3. Common Errors and Safety Notes

   a. Not anticipating ground effect and allowing the descent to stop, resulting in a hover

   b. Rushing or anticipating ground contact and lowering collective too quickly, resulting in a firm landing

   c. Failure to eliminate drift

   d. Allowing the nose to yaw due to rapid application of collective and/or improper use of pedals

   e. Allowing scan to move inward too close to the aircraft and fixating on the spot

   f. Poor cyclic control, lowering the nose before touchdown, and allowing the aircraft to slide forward after ground contact

   g. Excessive nose high attitude at low altitude, resulting in the tail skid contacting the ground, which may cause serious structural damage to the aircraft

   h. Ensuring nose attitude is less than eight degrees passing ten feet

516. SLIDING LANDING

Maneuver Description. The sliding landing utilizes ground effect and translational lift to reduce the power required for landing under high gross weight, high-DA conditions, or reduced power available conditions (Figure 5-10).

Application. The sliding landing is practiced to simulate conditions when HIGE is not possible or when maximum gross weight or DA prohibit a hover. Additionally, a sliding touchdown gives the pilot the advantage of greater helicopter controllability during touchdown under high gross weight conditions.

1. Procedures

    a. Begin with an approach to landing.

    b. Approaching short final, set nose attitude ten degrees above the horizon to continue reducing airspeed.

        – Flying 10–15 degrees nose above the horizon will provide sufficient ability to slow aircraft.

    c. Passing through 30 feet AGL and approximately 30 KGS, adjust nose to five degrees above the horizon.

        – For a sliding landing to be effective, the helicopter must remain in effective translational lift until transitioning to the touchdown attitude.

    d. Allow the aircraft to touchdown between 5 and 30 KGS and lower collective full down while maintaining directional control with pedals.

        i. Five-degree nose up will maintain your current speed

        ii. Allow touchdown while maintaining heading with pedals.

        iii. Tail will not touch the ground with pitch attitude up to eight degrees.

        iv. Once stopped, lower collective to full down position.

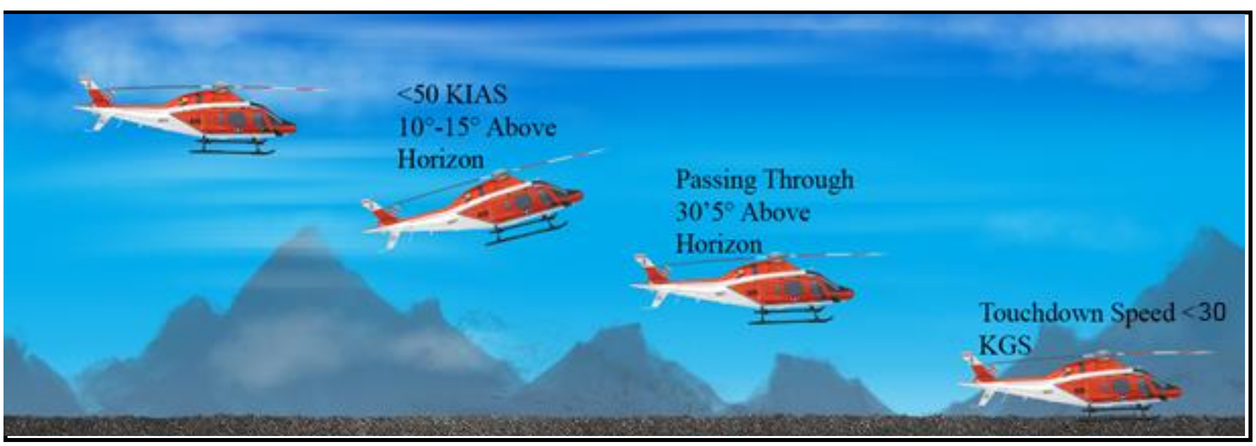

Figure 5-10 Sliding Landing

2. Amplification and Techniques

– The IP may elect to execute a touch and go by smoothly adding power to lift the helicopter off the deck and intercept a normal takeoff profile.

WARNING

Failure to align the aircraft with direction of travel may result in dynamic rollover.

CAUTION

Reduction of the collective at an excessive rate and/or magnitude upon touchdown may result in left yay of the aircraft across the runway, or if landing performed on the grass, the skids may dig in and the aircraft rocking forward precipitously.

3. Common Errors and Safety Notes

a. Do not land the helicopter with lateral drift. Compensate for any crosswind with wing down, top rudder crosswind correction. Ensure skids are aligned with ground track.

b. Avoid the common tendency to fixate on the ground during touchdown.

c. Do not allow the helicopter to become excessively nose high or low at low altitude. The tail rotor may strike the ground as a direct or indirect result of either. Nose attitude above eight degrees will cause tail skid contact with ground.

d. Avoid swiftly lowering the collective upon touchdown, as this may cause rapid left yaw and over increase the changes of dynamic rollover.

517. POWER ON WAVE-OFF

Maneuver Description. The wave-off with power on enables the pilot to terminate an approach or descent and transition to a normal climb.

Application. The wave-off is a transition from a low power, descending flight condition to a power on climb, often used when conditions in the LZ do not allow continuation to the ground.

1. Procedures

a. Ensure the twist grip is in flight.

b. Increase the collective to stop the ROD (approximately 50–70 percent torque) and establish positive ROC.

– In most cases, initially setting 50 percent torque will significantly slow or stop the ROD.

c. Adjust the nose to 70-KIAS climbing attitude and maintain balanced flight.

2. Amplification and Techniques

a. Monitor engine instruments when executing a wave-off. Until normal wave-off engine power is assured, maintain the aircraft within safe autorotational parameters.

b. Execute the maneuver smoothly, yet positively.

3. Common Errors and Safety Notes

a. Ensure you are responding to a condition requiring wave-off.

b. Do not fail to ensure twist grip is flight.

c. Do not fail to transition to the 70-KIAS climbing attitude.

d. Do not fail to maintain balanced flight.

e. Do not fail to maintain climb at 500–700-fpm.

f. Do not fail to keep torque within limits.

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CHAPTER SIX
POWER OFF MANEUVERS

600. INTRODUCTION

This chapter focuses on power off maneuvers and autorotational flight. The skills necessary to fly the helicopter in the unlikely event of a complete engine failure are critical. These skills are especially pertinent while flying single-engine helicopters.

Procedural knowledge, chair flight, and repetition are what make autorotational flight nearly second nature to the skilled helicopter pilot. A thorough and working knowledge of the procedures, aerodynamic profile, and factors are crucial to the execution of a successful power off maneuver or autorotation.

Power off maneuvers and autorotations will be introduced in a hover, in a hover taxi, and finally in the pattern. Before your first solo, you will be able to fly the aircraft through the transition for powered flight to autorotational flight, maneuver for landing, and execute a safe landing. With sound understanding of the procedures, these maneuvers can become some of the most rewarding maneuvers you will fly. Your ability to successfully complete a practice autorotation will build confidence in your ability to execute a landing in the event engine loss. Challenge yourself to be as smooth on the controls as your Instructor.

601. SIMULATED ENGINE FAILURE IN A HOVER AND HOVER TAXI

1. Procedures

   a. Establish a stable 3-5 foot AGL hover, or 5-20 kt hover taxi within 45 degrees of the windline. The instructor will rotate twist grip to idle to simulate loss of power.

      – Instructor will announce, “Simulated.”

   b. Maintain collective setting and allow aircraft to settle.

      – Announce, “Freeze (the collective).

CAUTION

Collective pitch must be maintain to allow the helicopter to settle and preserve NR to cushion the landing.

   c. Use pedals to stop yaw, and cyclic to eliminate aft and/or sideward drift to ensure a level attitude (5 degrees nose up).

      i. Announce, “Stop (yaw and drift).”

      ii. Anticipate right pedal and slight forward cyclic pressure.

iii. If yaw develops from a hover, use sufficient pedal input to stop the rotation and accept the new heading.

iv. If yaw develops in a taxi, realign heading with the helicopter's direction of travel before touchdown.

v. In a hover taxi, maintain forward groundspeed.

CAUTION

Attempting to stop forward drift may result in a nose high condition near the ground and a tail strike.

d. As the aircraft settles, use collective to cushion the landing.

i. Announce, "Cushion, cushion, cushion."

ii. Increase collective smoothly commensurate with ROD to cushion landing.

iii. Once the collective is increased, it should not be decreased prior to touchdown. If too much collective has been applied, freeze the collective and allow the aircraft to resume a comfortable ROD. Then, cushion the touchdown with remaining NR.

iv. The helicopter will land on the back of the skids first and then rotate forward.

e. When both skids are firmly on the ground, smoothly lower the collective full down and neutralize the controls.

2. Amplification and Technique

a. The most important aspect of this maneuver is attitude control. Drift must be eliminated, and the helicopter stabilized prior to touchdown. Achieve a level attitude for the landing. A level attitude is defined as approximately 5 degrees nose up.

b. Once power is reduced to idle, the helicopter will tend to yaw left, drift aft, and drift left due to the significant reduction in torque. The PAC can expect to add right pedal as well as forward and right cyclic inputs.

c. The helicopter tends to drift left after an engine failure due to loss of tail rotor thrust pulling the helicopter to the right (translating tendency). Scan out to maintain heading and use slight right pedal to reduce tail rotor pitch to match the growing torque loss, or the nose will yaw left.

d. When executed from a hover, do not drift aft or laterally. Slight forward groundspeed is acceptable.

e. As NR decreases, lift also decreases making control inputs increasingly less effective. Control inputs to set a landing attitude should be made early so only small corrections are needed at lower NR.

CAUTION

Large cyclic inputs, especially aft, with low NR may result in rotor blades contacting the helicopter.

f. The helicopter will tend to hold altitude momentarily, allowing a short window to get drift and yaw under control. The helicopter will then begin to settle. Let it settle. Increasing collective to hold altitude leaves insufficient NR to cushion the landing. This may result in a hard landing. Approaching the ground, smoothly increase collective to reduce, but not eliminate, the ROD. Do not wait too long to respond with collective, since too little, too late may also result in a hard landing.

g. Maintain a hover scan. Your peripheral vision tells you how high you are within a matter of inches.

h. Continue to keep the aircraft level and aligned with the direction of travel until the weight has transferred to the deck, then smoothly reduce the collective. Use pedals as required to control yaw until the helicopter comes to a stop.

3. Common Errors and Safety Notes

a. Select a flat area to land.

b. The pilot must use the hover scan to ensure proper attitude for touchdown.

c. Use enough collective to cushion the landing, but allow the helicopter to still fall to the deck. Using too much NR early will leave no useable lift to cushion as the helicopter reaches the decl. Make sure to use enough collective pull to cushion the landing. Pulling too much early or not enough at all may both lead a hard landing.

d. Stay relaxed on the controls. Natural human stress response is to inadvertently pull aft cyclic and immediate up collective.

602. AUTOROTATIONS AND SIMULATED ENGINE FAILURE AT ALTITUDE

Maneuver Description. An autorotation is a condition of non-powered flight in which rotor RPM and thrust are produced from the reversed airflow through the rotor system. Autorotations enable the pilot to land safely in the event of a loss of power at altitude (Figure 6-1).

Practice autorotations are preannounced. Once the aircraft is setup, the Instructor will initiate by moving the twist grip to idle. IUTs can manipulate the twist grip.

Application. An autorotation occurs when the rotor system is driven by aerodynamic forces rather than by the engine. Rotor speed and thrust are sustained by energy that is derived from the airflow passing upward through the rotor system as the helicopter descends. Understanding the dynamics specific to autorotative flight forms the core for executing many EP (e.g., engine failure and fire in flight).

1. Procedures

   a. Fly downwind at 80 KIAS and a minimum of 600 feet AGL (straight in or 90 degree) or 800 feet AGL (180-degree of HOGE).

   b. Announce, "Sock and lane."

      i. Check windsock, ensure there is no tailwind component, and note any crosswind.

      ii. Check lane and ensure 90- or 180-degree autorotation lane is clear of obstacles. State intended area of recovery or landing (e.g., the left side of the runway). Call out any traffic in the lane.

   c. Prior to entry, confirm entry parameters are obtained.

      i. Check altitude and airspeed, and announce, "_________ feet and 80 kts."

      ii. Trim and center ball, and announce, "Aircraft in trim."

   d. The Instructor will initiate the maneuver by reducing twist grip to idle. Lower the collective, adjust NR, and add right pedal to maintain balanced flight while turning to course line, as required. Use the following verbal procedures:

      i. Instructor/IUT

         (a). If pre-announced: "Initiating 3, 2, 1, idle" – Instructors reduces twist grip to idle.

         (b). If simulating an engine failure: Instructor reduces twist grip to idle then, "simulated."

      ii. Student/IUT

         (a). "Down" – Smoothly lower the collective to the full down position and then adjust to control NR.

         (b). "Right" – Use right pedal as necessary to center the ball and maintain balanced flight.

(c). “Transition” – Use cyclic to transition to an 80 KIAS descending attitude.

(d). “Turn” – Maintain balanced flight, initiate a turn to intercept course line, and establish crosswind correction as necessary.

e. Transition to the 80–90-KIAS descending attitude. Monitor NR and control between 90 and 110 percent with collective (target 98–102 percent). Maintain balanced flight. Use the following verbal procedures:

i. “Attitude” – Trim for an 80–90-KIAS descending attitude.

ii. “NR” – Use collective to control NR between 90 and 110 percent.

iii. “Ball” – Use pedals to maintain ball centered.

f. Intercept the course line and establish crosswind correction as necessary. Maintain the 80–90-KIAS descending attitude.

g. At no lower than 250 feet AGL, ensure the aircraft is on course line.

– Announce, “250 feet on course line.”

h. At 150 feet AGL, begin flare with cyclic in order to reduce ROD and reduce groundspeed. Control NR with collective and use pedals to align nose with direction of travel.

i. Announce, “150 feet flare.”

ii. Ball may not be centered when aligning nose with direction of travel.

i. Following the flare, the Instructor/IUT will smoothly rotate twist grip to FLIGHT for the power recovery autorotation or remain at IDLE for the full autorotation.

i. The IP/IUT will announce, “Twist grip FLIGHT” for power recovery or “Twist grip IDLE” for full autorotation.

ii. The other pilot verbalizes verification with “Twist grip FLIGHT” or “Twist grip IDLE” for full autorotation.

CAUTION

Increasing twist grip during a power recover autorotation may cause N2 overspeed. Immediately following the flare, note NR below 103 percent and not increasing. A small increase in collective may be necessary to reduce NR and stop increase.

j. Adjust flare, as required, to achieve desired groundspeed and minimal ROD.

– The goal is a minimal ROD at 30 feet AGL.

k. At 20–30 feet AGL, coordinate up collective as necessary and forward cyclic to slow the ROD and lower the nose to level (approximately 5-degree nose up). Use the following verbal procedures:

i. "Check" – Increase collective slightly to reduce ROD and groundspeed.

ii. "Pause" – Allow a moment for aircraft ROD and groundspeed to decrease.

iii. "Level" – Apply forward cyclic to level the aircraft passing 10-15 ft AGL.

2. Recover in a forward hover taxi for the power recovery autorotation or cushion the landing for the full autorotation.

a. Power recovery – Recover in a 5-foot hover taxi at a safe speed. Announce, "Taxi, taxi, taxi." A typical safe speed is 30±10 KGS.

b. Full – Use collective as necessary to cushion the landing and touchdown at a safe speed. Align skids with direction of travel. Announce, "Cushion, cushion, cushion." A typical safe touchdown speed is 25±10KGS.

CAUTION

Landing with zero KGS may be required in some real emergencies, but performing a practice zero/zero autorotation leaves no margin for error and could cause damage to the aircraft if over controlled or done improperly. If the aircraft slows too much, it may encounter a vertical ROD and rapid NR decay that is likely to result in a hard landing.

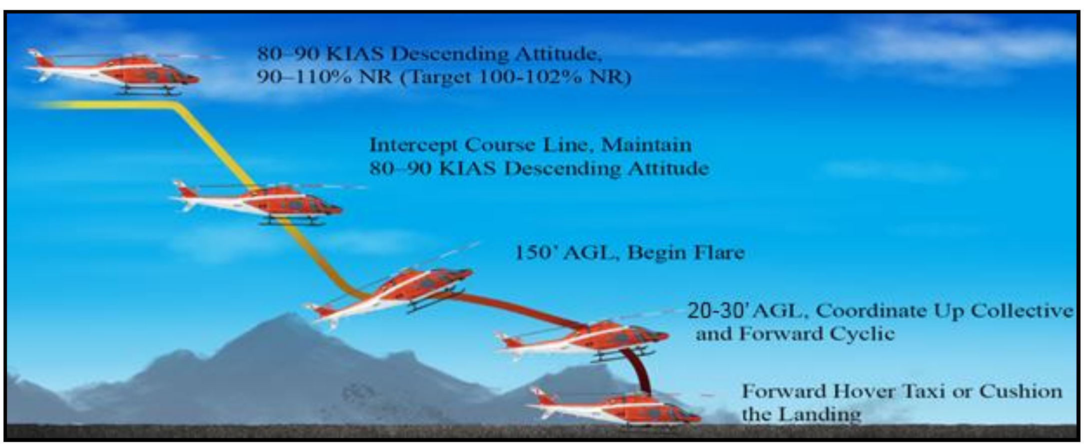

Figure 6-1 Autorotation Profile

3. CRM

a. PAC briefs crew prior to each practice autorotation and includes type of auto and type of recovery.

b. PAC/PNAC ensures landing area is clear. (Situational Awareness)

c. PAC/PNAC ensures flare is initiated at 125-150 feet and follows with report of twist grip position. (Situational Awareness)

4. Amplification and Technique

a. General

i. Autorotation entries may be practiced from the straight in, 90- and 180- degree positions. All practice autorotations shall be entered from at or above 600 feet AGL, 80 KIAS, and balanced flight in a wings level attitude.

ii. The autorotations may either be pre-announced and initiated with a countdown, or the IP will initiate the maneuver and then announce “simulated” to simulate an engine failure.

iii. The PAC will then smoothly and judiciously lower the collective to full down to stop NR decay and bring it back to an acceptable range. Simultaneously adjust pedals to maintain balance flight (center ball) and adjust the cyclic to the appropriate attitude using the horizon as a reference (for higher gross weight autos, expect more nose down) while turning toward the course line. Ensure that the engine is still running by checking N1 and IT.

iv. After entry, increase collective to maintain NR in range. NR will begin to accelerate once the collective is lowered to the full down position. Approximately one inch above the full down position will slow the acceleration of NR and may keep it from exceeding 110%. This is just an estimation and the collective must be adjusted as necessary to ensure NR limits are not exceeded.

v. Rotor RPM will build anytime G- forces are applied to the rotor system. This occurs during the turn to the course line. The rate of acceleration of NR depends on how quickly G-loading decreases when rolling out from a turn.

vi. Once the collective has been lowered and the twist grip rotated to flight idle, the helicopter will begin to lose altitude. From all entry positions, but particularly true of the 180-degree entry, a primary concern is getting the aircraft into the course line with as much altitude as possible. A starting point of 30-50 degrees angle of bank through the first 90 degrees of turn for a 180-degree autorotation is a good starting point. Use the second part of the turn to adjust as necessary for the intended area.

vii. Additionally, out of balanced flight condition and improper descending attitude will also result in an increased ROD.

viii. Ensure the helicopter is on course line by 300 feet AGL with NR 90-110%, and airspeed 70-100 KIAS. The IP/IUT shall execute a power off wave-off if any of these parameters are not met.

ix. During the turn to the course line, a scan pattern to see outside as well as inside the cockpit should be used. Of primary importance outside is maintaining the appropriate attitude and a proper rate of turn. Essential items to scan inside are airspeed, NR, and the balance ball (summarized as "Attitude, NR, and ball"). Use the inside scan to verify these parameters.

x. Upon reaching the course line, set the appropriate crosswind correction.

xi. At 125-150 feet AGL, use aft cyclic to initiate a flare to slow the rate of descent. A progressive flare, a gradual increase in nose attitude, will also result in an increase in NR and a decrease in groundspeed. A slight increase in collective may be necessary to maintain NR in limits. After initiating the flare, open the twist grip. There will be sufficient time for a positive, smooth rotation to flight. Below 150 feet AGL, both pilots are primarily focused on an outside scan. The goal is to have minimal ROD through use of the flare at appropriately 20-30 feet AGL.

xii. An autorotation can be thought of in terms of energy management, or balancing potential energy (height above ground), kinetic energy (airspeed/ROD), and rotational energy (NR). Every autorotational flare will be different. Nose attitude 15-25 degrees up may be necessary. The amount of flare required will be a function of the existing wind conditions, airspeed, DA, and the aircraft gross weight. Do not be mechanical! Scan outside for groundspeed and ROD, and adjust the nose attitude to make appropriate corrections. Maintain an outside scan.

b. Power Recovery

i. Power recovery autos are practiced so that you will become comfortable with autorotative procedures prior to being introduced to full autos.

ii. The IP/IUT will ensure NR is stable or decreasing below 103% prior to rotating the twist grip to flight. The IP/IUT may need to slightly increase the collective to ensure NR is below 103% and stable. The twist grip shall then be rotated to the flight position at a smooth rate. The mnemonic "twist grip, twist grip, twist grip, flight" may aid in rotating the twist grip to flight at an appropriate rate.

CAUTION

Failure to control NR in the flare prior to rotating the twist grip to flight may lead to an overspeed of N2 and/or NR. An increase in collective to attempt to reduce N2/NR once to twist grip is in flight may aggravate the overspeed.

iii. Both pilots are responsible for verbally confirming the twist grip is in flight.

iv. At approximately 20-30 feet, slightly increase, or check, the collective sufficiently to slow ROD but do not stop it. Pause to all

v. At 10-15 feet AGL, use forward cyclic to level the nose (approximately 5 degrees above the horizon), then increase collective smoothly to arrest the ROD and establish a 5 ft AGL hover taxi at 30±10 KGS.

vi. Once the aircraft is stabilized in a hover taxi, check the instruments, and CAS messages, then a transition to forward flight may be initiated at the IP's discretion. With minimum delay in the air taxi, no clearing turns are necessary.

vii. Avoid the tendency to either scan too close to the aircraft or fixate on the landing area. Failure to scan out may result in a nose-high attitude and striking the tail.

c. Full Autorotation

i. A full autorotation is performed in the same manner as the practice autorotation with power recovery except that the twist grip remains at flight idle throughout the maneuver.

ii. At 20-30 feet, use a collective check (slight increase) as necessary to slow the ROD but do not stop it. Pause to allow the control input to take effect. This check also has the benefit of aiding in reducing groundspeed and leveling the nose.

iii. Remember to keep the scan moving; do not fixate on the landing area.

iv. At 10-15 feet AGL, use forward cyclic to level the nose, then increase collective smoothly to arrest the ROD to touchdown smoothly.

v. As you level the nose, the maneuver should look very similar to a simulated engine failure in a hover taxi.

CAUTION

A nose attitude greater than 10 degrees at 10 feet AGL or less may result in a tail strike. Ensure proper nose attitude is attained prior to 10 feet AGL.

vi. Make every effort to control the ROD with collective when approaching the ground for touchdown. Cushion the landing; do not just raise the collective. Keep the level attitude and maintain heading with the pedals.

vii. Touchdown at a safe speed, ensure skids aligned with direction of travel. A typical safe touchdown speed is 25±10 KGS.

viii. Reduce the collective to the full down position when the aircraft has come to a complete stop.

ix. Maintain aircraft heading with pedals.

5. Common Errors and Safety Notes

a. Failure to execute a wave-off when the helicopter is well outside established FTI parameters. A wave-off shall be initiated if, by 250 feet AGL, the airspeed is not 70-100 KIAS, NR is less than 90%, or the helicopter is not on course line. A wave-off shall also be initiated anytime the instructor questions the ability to safely continue the maneuver.

b. Failure to enter the maneuver on altitude, airspeed, wings level, or out of balanced flight.

c. Failure to regain balance flight on entry and maintain it throughout the turn. Right pedal is required in an autorotative descent, even in a left turn.

d. Failure to ensure to control NR in limits

e. Failure to ensure 80-90 KIAS is maintained until the flare. If the helicopter is allowed to get too slow, there will not be enough kinetic energy left to flare.

f. A delayed turn, when required, will mean a lower altitude when arriving into the course line. Insufficient altitude once on course line decreases time available to properly execute autorotation procedures and may result in an overspeed or hard landing.

g. Failure to maintain heading while engine is spooling back to governed range.

h. Failure to establish the appropriate crosswind correction to prevent drift once on course line.

i. Flaring too low or too high

j. Initial collective pull either too high or too low, or improper amount.

k. Failure to use pedals to maintain heading when increasing collective to slow ROD with power recovery autorotations.

l. Avoid excessive groundspeed

m. Landing with aircraft skids not aligned with direction of travel

n. Insufficient cushioning on full autorotations at the right altitude. Collective pulled too high, resulting in NR too low for control of ground contact and tail rotor control inadequate to hold heading. Collective pulled too late, resulting in a fast touchdown and a hard uncontrollable landing.

o. Avoid leveling the nose too soon or too fast or prevent acceleration and excessive groundspeed

p. Failure to ensure nose attitude less than 8 degrees up on touchdown, to prevent tail skid contact with the ground

q. Avoid abrupt control inputs on touchdown or lowering the collective too fast and/or too soon once the skids have touched the deck. Large cyclic inputs, especially aft, with low NR may result in rotor blades contacting the helicopter.

r. Not realizing where the winds are coming from and at what intensity when initiating maneuver.

603. POWER OFF WAVE-OFF (IP/IUT ONLY)

Maneuver Description. The wave-off enables the pilot to terminate a simulated EP or autorotative descent and transition to a normal climb or forward flight.

Application. The wave-off with power off is a transition from any situation where the twist grip is not in the flight position to execute a power on climb or forward flight.

1. Procedures

Time and altitude permitting:

a. Collective will normally need to be raised to ensure N2 limits are not exceeded. Ensure NR is below 103% and stable prior to rotating twist grip to flight.

    i. Collective may need to be raised to ensure N2 limits are not exceeded as twist grip is moved to the flight position.

ii. PAC verbalizes, “Twist grip flight.”

iii. PNAC shall confirm and verbalize, “Roger, twist grip flight.”

b. Increase the collective to stop the ROD (approximately 50-70 percent) and establish positive ROC.

– In most cases, initially setting 50 percent torque will significantly slow or stop the ROD.

c. Adjust the nose to 70-KIAS climbing attitude and maintain balanced flight.

2. Amplification and Techniques

a. Execute the maneuver smoothly, yet positively.

b. Monitor rotor RPM closely when executing a wave-off; do not allow NR to over-speed.

c. Until normal wave-off engine power is assured, maintain the aircraft within safe autorotational parameters.

3. Common Errors and Safety Notes

a. Failure to ensure twist grip is flight

b. Failure to transition to the 70-KIAS climbing attitude

c. Failure to maintain balance flight

d. Failure to maintain climb at 500–700 fpm

e. Ensure N2/NR remain within limits.

CHAPTER SEVEN
EMERGENCY PROCEDURES

700. INTRODUCTION

This chapter introduces the necessary EPs for day familiarization flights. Learning EPs is a necessary aspect of flying. All aviators should be knowledgeable of the procedures contained in the applicable NATOPS manual and thoroughly aware of the capabilities and limitations of their aircraft. This is the only way to adequately and safely cope with any emergency situation encountered in flight. Simulated emergency training, engine failures, caution and warning lights, system malfunctions, and irregular single instrument indications are used to achieve a proficient and confident response to emergencies.

701. LEARNING EPS

The EPs required for this aircraft are explained in chapter 12 of NATOPS, and additional aerodynamic emergency information can be found in chapter 11. In all EPs, apply the Aviate, Navigate, Communicate axiom. The familiarization stage is primarily concerned with the first step. When learning to aviate in emergency conditions, use the approach to set priorities and make decisions.

Emergencies fall into two categories: those requiring immediate pilot reaction in order to prevent further difficulty and those that do not. To make an immediate and accurate distinction, consider that any loss of power, control, or structural integrity requires immediate action in order to continue aviating. In general, any other abnormalities are of a noncritical nature. NATOPS EP steps are geared toward either: 1) maintaining or regaining power available, 2) maintaining control (NR, cyclic, or tail rotor authority), or 3) minimizing further damage and getting the helicopter on deck.

Critical emergencies require immediate identification and reaction. Not all situations requiring immediate action are listed in the EP chapter. Examples of these emergencies are VRS, unusual attitudes, and bird strikes. Additionally, not all emergency situations arise from aircraft malfunctions.

The second category of emergencies, the noncritical group, consists of those indications of an impending failure, which, if not analyzed and handled quickly, could develop into a critical or immediate response situation. These situations afford the pilot a few moments to analyze the malfunction, minimize impact, and fly to a controlled landing. Examples of these situations are instrument and caution panel indications, sounds, and vibrations.

When, after a few moments of careful analysis, the pilot determines the abnormal indications will not likely develop into one of the two categories of emergencies discussed above, the pilot will initiate action for a system failure. The required action may range from altering or aborting the planned mission to merely noting the problem for maintenance action and then continuing as planned.

In later stages of training, students will be expected to consider additional factors such as crew, environment, other aircraft, and controlling agencies, as discussed in the corresponding FTIs.

For simulated emergencies on deck:

- Recite all memory items.
- Call for the Pocket Checklist (PCL).
- Be familiar with (do not memorize) all non-memory items from NATOPS checklists.

702. CREW ALERTING SYSTEM MESSAGES

To simulate a malfunction, the IP may ask, “What would you do if an ENG OIL PRESS CAS message appeared?” or, “What would you do if transmission oil pressure is less than 30 psi?” Simulated over-temperature, loss of pressure, and abnormal indications on performance instruments require analysis of the fault and identification of the proper procedure. Consider each instrument and ask the following question: What would you do if that instrument fluctuates, falls low, or exceeds maximum or normal operating limits?

703. SIMULATED EMERGENCIES AT ALTITUDE

Maneuver Description. Simulated emergencies are Instructor-initiated maneuvers designed to analyze the student’s understanding of, and proper response to, various simulated emergency conditions or situations.

Application. Simulated emergencies are practiced on every flight to challenge the student’s knowledge of systems malfunctions and evaluate the headwork, basic air work, and procedures involved in correctly responding to various simulated emergency conditions or situations.

1. Procedures

   a. The Instructor initiates the maneuver by inducing or informing the student of the simulated emergency condition or situation.

      – For example, “N1 is fluctuating, ITT is increasing abnormally high, torque is reduced, and you hear a popping noise.”

   b. Maintain control of the aircraft, ideally towards the nearest landing site where a safe landing can be made, and alert the crew to the condition.

      – Since helicopters do not glide well and have the option to land in a field, turning towards a landing site is recommended. It is easier to finish the EP with a landing site readily available and not have landing criteria than to realize your situation has a landing criteria after flying away from a suitable landing site.

c. Determine the precise nature of the problem.

i. Identify the emergency condition or situation, such as, “We have a compressor stall.”

ii. Sound knowledge of EPs allows anticipation of landing criteria at stake.

d. Complete the applicable EP or take action as appropriate for the problem.

i. Recite the applicable NATOPS critical memory items and simulate or delegate completion as appropriate. For example, “Collective, lower to clear the stall; airspeed 60-70 KIAS…”

ii. Task the PNAC to break out the PCL at the completion of the memory items even if non-memory items are not associated with the emergency.

e. Determine the landing criteria.

– “Sir/ma’am, we have a land as soon as practical/possible emergency.”

f. Delegate emergency landing steps:

i. “Lock” – Both pilots lock shoulder harness.

ii. “Talk” – PNAC makes an appropriate (simulated) emergency radio transmission.

iii. “Squawk” – Transponder is set to 7700 emergency (call for but simulate).

iv. Time permitting, PAC calls for the PNAC to conduct landing checks.

2. Away from a Field

– Set up for an approach appropriate to the emergency but initiate wave-off by 400 feet AGL to recover, but no lower than 300 feet and no slower than 60 KIAS.

3. At a Field/OLF

– Terminate in an appropriate landing for the emergency.

– For example, simulated compressor stalls may be completed to a sliding landing if insufficient power exists to execute a vertical landing.

4. Amplification and Technique

a. When airborne, an emergency landing site should always be in mind. In the event of an actual or simulated emergency, little or no time should be wasted in beginning an approach to a landing site. Ask your Instructor about techniques for site selection.

b. If the aircraft was at Pond Creek Bridge, inbound to Spencer, "Land as soon as practicable" may be interpreted as landing at the nearest aerodrome (Spencer). Flying by one aerodrome to continue to another would therefore constitute extended flight. If on a cross-country and an aerodrome is not within a reasonable distance (further than 15–20 minutes flight time), consideration should be given to landing at a site (e.g., farmer's field) at which the pilot is positively sure the landing will result in zero damage to the aircraft or private property.

c. Very few emergencies require immediate pilot response. Though autorotation is emphasized in the syllabus, it is not the correct first response to most emergencies. Do not enter an autorotation as an automatic response to an unexpected caution light stimulus.

5. Common Errors and Safety Notes

a. Entering an autorotation when a powered approach was appropriate

b. Failure to select a potential landing site prior to the simulated emergency

c. Failure to remember EPs in the air

d. Overshooting and/or undershooting LZ due to poor headwork and/or basic air work

e. Failure to initiate voice reports

f. Failure to plan practice approach into the wind

g. Failure to use copilot (CRM)

6. CRM

a. Ground Emergencies

i. Any crewmember recognizes and identifies an emergency. (Situational Awareness)

ii. Any crewmember announces emergency to all crewmembers. (Communication)

iii. PAC initiates emergency response by verbalizing memory items/procedures per NATOPS checklist to the entire crew while simultaneously completing appropriate procedures. (Leadership)

iv. PNAC backs up PAC on EPs and checklists and completes assigned procedures. (Adaptability and/or Flexibility)

v. PAC and/or PNAC notifies Ground and Tower when problems exist that could require emergency response and/or assistance. The PAC should execute checklist items which require control inputs and the PNAC should complete all other checklist items. (Communication)

vi. Generally, CRM for which pilot should do what is split into PAC executing checklist items which require control inputs and PNAC completing all other checklist items. This holds true for ground emergencies as well. For example, during a hot start, the PAC will get the twist grip off and then hold in the starter push button after the PNAC turns the ignition switch off. Then, the PNAC will also move the fuel panel switched to the off and closed positions.

b. Airborne Emergencies

i. Any crewmember recognizes and identifies an emergency. (Situational Awareness)

ii. Any crewmember announces emergency to all crewmembers. (Communication)

iii. PAC flies aircraft – Aviate. (Situational Awareness)

iv. PAC initiates emergency response by verbalizing memory items/procedures per NATOPS checklist to the entire crew while simultaneously completing appropriate procedures. (Leadership)

v. PNAC backs up PAC on EPs and checklists and completes assigned procedures. The PAC should execute checklist items which require control inputs and the PNAC should complete all other checklist items. (Adaptability/Flexibility)

vi. PNAC breaks out NATOPS PCL, verbalizing EPs. (Communication)

vii. PNAC obtains dual concurrence from PAC on system switches. (Communication)

viii. PAC navigates aircraft to safe landing site. (Adaptability and/or Flexibility)

ix. PNAC transmits PAN/MAYDAY on guard (over ICS if simulated). (Communication)

x. PNAC squawks emergency (if applicable). (Communication)

704. HYDRAULIC BOOST-OFF APPROACH

Maneuver Description. The boost-off approach acquaints the pilot with the techniques used to make a safe landing in the event of a No. 1 hydraulic system failure.

Application. With loss of the No. 1 hydraulic system, the No. 2 hydraulic system will automatically provide hydraulic boost to the cyclic and collective. The tail rotor, however, will no longer be boosted, making inputs significantly more difficult and will require more precise (smaller) collective movements. Because of this, pedal inputs will need to be anticipated.

1. Procedures

    a. In the upwind, the IP will introduce a No. 1 hydraulic system failure.

        i. Complete the appropriate NATOPS EP.

        ii. Make the appropriate radio call.

        iii. Increased force will be required for pedal control movement.

    b. Fly a shallow approach with focus on minimizing power changes on final.

        – Pedals will be stiff. Anticipate pedal application and maintain pressure on pedals throughout the maneuver. Increasing collective will require left pedal application; be proactive with inputs.

    c. This maneuver may be landed via a sliding landing or taken to a hover followed by a vertical landing.

        i. If executing a sliding landing, ensure skids are aligned with direction of travel prior to setting down.

        ii. If executing a vertical landing, arrive in a 10 feet AGL hover, then turn into the windline.

    d. Once aircraft is stabilized, lower collective to effect landing.

NOTE

Due to the sloppy link, the aircraft will have a tendency for a delayed left yaw when landing. Anticipate early right pedal input as collective is lowered.

2. Amplification and Technique

    a. When setting up for a landing, a headwind with a left crosswind component will reduce pedal input required due to increased Angle of Attach (AOA) of the tail rotor. Right crosswinds will require more pedal input and are not desirable.

    b. Pedal inputs must be anticipated to prevent swinging of nose past center position.

c. Stabilizing momentarily in a 10 feet AGL hover taxi prior to executing a sliding landing may help the pilot identify any corrections that need to be made prior to touchdown.

d. A shallow approach that allows for minimal and incremental power changes will help minimize pedal inputs.

3. Common Errors and Safety Notes

a. High on final and insufficient setup arriving on final.

b. Failing to maintain good basic air work.

c. Making pedal inputs too slowly and over correcting heading.

d. Failure to ensure the helicopter is stable in the appropriate landing attitude prior to landing.

705. STABILITY AUGMENTATION SYSTEM (SAS) OFF

Maneuver Description. The TH-73A is equipped with a Stability Augmentation System (SAS) to help stabilize the aircraft and provide rate dampening. A failure of one SAS will cause the remaining SAS actuator to work twice as fast to provide proper inputs. A failure of both SAS channels will cause the aircraft to lose it stabilization and rate dampening, requiring increased pilot workload for aircraft control.

Application. The SAS off maneuver allows the pilot to fly without servo-assisted controls and to provide recognition of a dual SAS malfunction.

1. Procedures

a. The IP will initiate the maneuver by securing SAS 1 & 2 on downwind.

– Complete the appropriate NATOPS EP.

b. Fly a shallow approach to arrive at a ten-foot hover over intended point of landing.

– Abrupt, incorrect, or uncoordinated cyclic and collective inputs may cause ballooning, sinking, or stair stepping on the approach glideslope.

c. Once stabilized at a ten-foot hover, gently reduce collective to land the aircraft.

i. Scan forward and down to see and stop drift.

ii. Smaller amplitude and less frequent control inputs will prevent over controlling.

2. Amplification and Technique

   a. Constant depression of the FORCE TRIM button during the hover transition may improve aircraft control.

   b. The force trim system is still operable with the SAS system secured. If choosing to use the FTR cyclic trim, ensure proper technique.

   c. Turn directly into the wind line once in a hover to increase flow over the vertical fin and improve control of the aircraft.

   d. Maintain smooth inputs and anticipate flight controls inputs early to avoid abrupt movements.

3. Common Errors and Safety Notes

   a. Do not rush the maneuver.

   b. Ensure a shallow approach to minimize excessive control inputs in the hover transition.

   c. If, during the maneuver, the aircraft cannot be controlled safely, either the IP or Student Naval Aviator (SNA) may reactivate the SAS system.

706. SIMULATED FIXED PITCH PEDAL POSITION AT ALTITUDE (IP/IUT; SNA SIMULATOR ONLY)

Maneuver Description. This maneuver allows the safe landing of an aircraft in a simulated stuck-pedal condition in which the tail rotor does not change pitch.

Application. This maneuver is designed to increase pilot proficiency in recovering from a fixed-pedal condition in forward flight using aerodynamic forces (airspeed) and power (torque) to control the alignment of the nose.

1. Procedures

   a. At some point after takeoff, the IP will announce “my pedals,” then set and/or freeze the pedals. Maintain 300-500 feet AGL and 80 KIAS on downwind.

   b. Execute a shallow approach to arrive over to runway threshold at 15 feet AGL. The aircraft should be yawed left approximately 20 to 60 degrees.

      i. The nose will be yawed furthest to the left at approximately 60 KIAS.

      ii. Use slight aft cyclic and small power changes to control altitude and proper nose left sight picture.

c. Slowly reduce airspeed with cyclic and descend to 3-5 ft AGL above the runway. If needed, smoothly and slowly add power to level off.

– The nose will yaw right commensurate with the rate and amount of collective application, and left with collective reduction.

d. As the nose starts to align with the runway, "freeze" the collective and cyclic to allow the aircraft to settle to the deck at 30 KGS or less, then slowly transfer the weight of the aircraft to the skids while sliding to a stop.

i. To reduce the rate of yaw and further reduce ground speed during a stuck right/ low power situation, the pilot can slowly reduce twist grip. Twist grip reduction will bring the nose back to the left if slightly right of lineup as the aircraft is slowed and power is increased. Coordinate the collective and twist grip to maintain nose alignment while reducing groundspeed.

ii. A stuck left/ high power situation will normally not require any twist grip manipulation. Under certain conditions, a zero groundspeed landing is possible.

iii. Twist grip (and collective) can also help control nose alignment while sliding to a stop (increase twist grip for nose right; decrease for nose left).

2. Amplification and Technique

a. Generally, there are three conditions of stuck pedal: stuck neutral (where the helicopter could be brought to a HIGE with no yaw), stuck right (low power as compared to HIGE), or stuck left (high power).

i. The pilot may elect to identify the type and severity of the stuck pedal condition at altitude by comparing the torque where balanced flight (ball centered) is possible with torque required to HIGE.

ii. Though not as accurate, the pedal position may give an indication as to what condition the tail rotor pitch became stuck. Left pedal forward roughly equates to a high power condition; right pedal forward roughly equates to a low power condition.

b. Recall that the helicopter will yaw to the left when the power is reduced and will yaw to the right when power is increased ('raise right, lower left').

i. In a stuck pedal situation, using power will "move" the aircraft to the ball (whereas, normally, the pedals will "move" the ball to the aircraft).

ii. Reducing twist grip will bring the nose to the left. This should only be done when in ground effect and preparing to land.

c. ***The key to success for a stuck pedal is to fly the sight picture on final.***

d. A left crosswind component is preferable with a low power (stuck right) condition. A right crosswind component is preferable with a high power (stuck left) condition.

e. When on final, mainly use the cyclic to control altitude and reduce airspeed, as movement of collective causes the aircraft to yaw more rapidly.

f. For stuck left/ high power situations, depending on gross weight, groundspeed, wind conditions, and torque application, at the end of the approach, the aircraft may stabilize in a hover or, more likely, begin a slow rotation in one direction or the other.

   – Landing with some yaw to a prepared landing surface is permissible; the friction of the skids on the pavement will assist in controlling the yaw as the aircraft settles.

g. For stuck right/ low power situations, the crew must expect and be prepared for a right yaw to develop as the approach is completed. Smoothly reducing the twist grip will bring the nose back left.

   i. The friction of the skids on the pavement will assist in controlling the yaw as the aircraft settles.

   ii. The corresponding decrease in torque created by lowering the collective for touchdown will aid in decreasing any remaining right yaw and can potentially generate a left yaw, depending on conditions.

3. Common Errors and Safety Notes

a. ***Always remember that pedals work and shall be used if conditions warrant***. Do not forgo needed pedal inputs for the sake of simulation.

b. Avoid rushing the maneuver or over controlling the helicopter.

c. For training, land with 30 KGS or less. Actual tail rotor malfunctions may require higher groundspeeds at landing.

d. Wave-offs and multiple attempts are possible with a stuck pedal condition.

e. If the nose is not yawed left to some degree on final, terminate the maneuver and execute a wave-off. Verify correct setup, ensure conditions (winds, gross weight, etc.) are optimized, and reattempt as desired, adjusting torque settings as needed. If still unable to achieve a left yaw in the descent, do not attempt to complete the maneuver.

707. VORTEX RING STATE (SIMULATOR ONLY)

Maneuver Description. The VRS is an aerodynamic condition in which a helicopter settles in its own downwash. This maneuver allows the aircraft to begin entry into VRS and the procedures to recover from VRS.

Application. The VRS can happen anytime when the aircraft is in an 800-fpm or greater descent and less than 40 KIAS. There are two methods for recovery from VRS: the Vuichard method and the forward displacement method.

1. Procedures

    a. Procedures to Begin Entry to VRS

        i. Establish a level flight condition at no lower than 2,000 feet AGL and 60 KIAS.

        ii. Commence a level deceleration and stabilize in a 9–10-kt hover; note torque.

        iii. Lower collective to reduce torque approximately 20 percent to initiate a descent.

        iv. When ROD exceeds 800 fpm, raise collective to increase torque approximately 20 percent.

            – Note aircraft vibrations, un-commanded pitch and roll, and ROD.

    b. Vuichard Recovery Method

        i. Raise collective.

            – Set torque to 75–85 percent in approximately three seconds.

        ii. Apply left pedal.

            – Maintain heading.

        iii. Apply right cyclic.

            – Set approximately 15–degree AOB.

        iv. Verify barometric altimeter indicates a climb and VRS indications have ceased.

2. Amplification and Technique

    – Clear working area before beginning procedure.

3. Common Errors and Safety Notes

– Do not descend below 1,000 feet throughout the maneuvers.

APPENDIX A
GLOSSARY

90º Position – The place in a VFR pattern in which the aircraft heading is 90º from the desired approach course as the pilot is turning from the downwind to final.

180º Position – The place in a VFR pattern that is abeam the intended point of landing on a heading 180º from the desired approach course. The pilot initiates the descent at this point.

Aborted takeoff – A maneuver that enables the pilot to stop transitioning to forward flight and land the helicopter.

Acceleration (a) – The rate of change of velocity per unit of time. It is a vector quantity.

Aileron – A flight control surface that adjusts the lift each wing of a fixed-wing aircraft independently, causing the aircraft to bank and turn.

Aircraft issue – The portion of maintenance control responsible for assigning aircraft to specific flight and ground training events.

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

Airspeed indicator – An aircraft instrument that shows how quickly the aircraft is moving through the air.

Altimeter – Aircraft instrument that shows the aircraft's altitude.

Altimeter setting – The value of the atmospheric pressure used to adjust the sub-scale of a pressure altimeter so that it indicates the height of an aircraft above a known reference surface.

Altitude – The height of an aircraft above a specific reference, usually either the ground or Mean Sea Level (MSL).

Angle of Attack (AOA) – The angle between the chord line of the blade and the relative airflow/wind. This angle is independent of the pitch angle.

Angle of Bank (AOB) – The angle of roll in either direction as compared to a level horizon.

Anti-torque device – A method used to counteract torque reaction of the helicopter fuselage in response to the rotation of the main rotor.

Anti-torque pedals – The pilot flight control that adjusts the amount of thrust generated by the tail rotor, thus counteracting the rotational torque effect of the main rotor. The pedals are used to maintain heading in a hover and to maintain balanced flight while in forward motion.

Artificial feel – An aspect of the force trim system that causes pilots to feel more resistance the further they move a flight control away from its trimmed position.

Attitude – The position of an aircraft as determined by the inclination of the axes to some frame of reference.

Attitude indicator – An aircraft instrument that shows the aircraft's attitude in relation to a level plane.

Attitude, NR, Ball – A mnemonic used to remember the scan pattern during an autorotative descent.

Autorotation – The descending flight of a helicopter without engine power where the air approaching from below the rotor disk (upward induced flow) keeps the rotor blades turning at an operational speed.

Aviate, Navigate, Communicate – An axiom by which pilots abide when faced with an emergency situation.

Axis – A line passing through a body about which the body rotates or may be assumed to rotate, any arbitrary line of reference such as a line about which the parts of a body or system are symmetrically distributed, or a line along which a force is directed; for example, an axis of thrust.

Blowback – The pitch-up tendency as the aircraft accelerates due to the flapping, which compensates for dissymmetry of lift.

Center of Gravity (CG) – A point within an object through which all the forces of gravity are considered to act.

Centrifugal force – The outward force created by the rotation of the main rotor and opposed by centripetal force.

Collective – The pilot flight control that adjusts the amount of thrust produced by the main rotor. It is comparable to the throttle in a fixed wing aircraft.

Collective feathering – The equal and simultaneous mechanical change of blade pitch (the AOI) of all rotor blades in a rotor system.

Control surface – A movable airfoil designed to be rotated or otherwise moved to change the speed or direction of an aircraft.

Crew Resource Management (CRM) – A process of coordinated action among crewmembers that enables them to interact effectively while performing mission tasks.

Critical memory items – Those steps in an emergency procedure that must be committed to memory and recited verbatim.

Cut gun – See Simulated Engine Failure in a Hover and Hover Taxi.

Cyclic – The pilot flight control that adjusts the pitch attitude and roll angle of the helicopter.

Cyclic feathering – The mechanical change of blade pitch (the AOI) of individual rotor blades independently of the other blades in the system.

Decay – A loss of NR that occurs when the engine can no longer deliver enough power to maintain NR at the desired constant setting.

Degraded visual environment – A condition on takeoff or landing in which the pilot has difficulty discerning the ground or the area around the helicopter due to dust, dirt, sand, debris, or snow kicked up by the helicopter's downwash.

Density Altitude (DA) – The altitude relative to standard atmospheric conditions at which the air density would be equal to the indicated air density at the place of observation.

Down, Right, Transition, Turn – A mnemonic used to remember the steps for entering an autorotation following an engine failure at altitude.

Downwash – The induced downward flow of air resulting from the passage of an airfoil (induced flow).

Downwind – The portion of a VFR traffic pattern that is flown 180º from the desired approach course.

Drift – Undesired movement away from the desired hover position over the ground.

Droop – A change in power turbine and rotor speed that occurs when a demand for more power is made.

Dynamic rollover – The lateral rolling of the helicopter onto its side due to exceeding the critical rollover angle regardless of cyclic corrections.

Effective Translational Lift (ETL) – The pronounced increased in translational lift during transition to forward flight (approximately 13–24 kts) due to the rotor disk experiencing a significantly decreased induced airflow.

Elevator – A flight control surface on a fixed wing aircraft that adjusts the pitch of the aircraft.

Energy – A scalar measure of a body's capacity to do work.

Familiarization level speed change – A maneuver in which the pilot practices accelerating and decelerating the aircraft while maintaining a constant heading and altitude under VFR conditions.

Familiarization turn pattern – A maneuver in which the pilot practices turning at increasing angles of bank while maintaining a constant altitude and airspeed.

Final – The straight away portion of an approach that leads directly to the intended point of landing on the desired approach heading.

Fixating – Staring at a single point or parameter instead of scanning all necessary parameters.

Flight director modes – Setting of the autopilot system that direct it to maintain specific parameters.

Flight path – The line connecting the continuous positions occupied or to be occupied by an aircraft as it moves with reference to the vertical or horizontal planes.

Force (F) – A vector quantity equal to a mass (m) times an acceleration (a). $F = m \times a$

Force trim – An aircraft system that allows the pilot to remove all the control forces for a given aircraft attitude. Trim is set using the Force Trim Release (FTR) button on the cyclic. The system also provides artificial feel to the pilot.

Forward displacement – A method of recovery from VRS in which the pilot decrease power and applies forward cyclic to fly out of the downwash.

Full autorotation – A practice autorotation in which the pilot leaves the twist grip in the flight idle positon and terminates the maneuver in a sliding landing.

Fuselage – The body to which most of helicopter's components are attached. It is the supporting structure of the aircraft.

Glideslope – The path and rate of descent of an aircraft preparing to land.

Gravity – An attraction of two objects for each other that depends on their mass and the distance between them.

Gross weight – The total weight of an aircraft and its contents.

Ground effect – The name given to the positive influence on the lifting characteristics of the horizontal surfaces of an aircraft wing when it is close to the ground.

Groundspeed (GS) – The horizontal speed of an aircraft relative to the ground. In no-wind condition, it is equal to the TAS.

Height-Velocity (H-V) Diagram – A chart that indicates those combinations of airspeed and altitude that should be avoided due to the difficulty of successfully autorotating should an engine failure occur in those regimes.

Heuristic – An explanation for something that enables people to better understand it.

Horsepower (hp) – The common unit of power, or the rate at which work is done, usually in reference to the output of engines or motors.

Hover – A constant position, altitude, and attitude maintained over a specific ground reference.

Hover Taxi/Air Taxi – Moving the helicopter in a hover along a prescribed ground track. A hover taxi is conducted in ground effect at less than 20 knots ground speed. An air taxi is conducted out of ground effect up to approximately 100 feet and at greater than 20 knots ground speed.

Hovering turns – A maneuver in which the helicopter is rotated about its vertical axis while maintaining position over a reference point.

Hover Out of Ground Effect (HOGE) Autorotation – A maneuver that demonstrates how airspeed can be regained and an autorotative landing accomplished in the event of an engine failure while in a high hover.

Humidity – The amount of water vapor in the air. As humidity increases, water molecules displace an equal number of air molecules.

Hydraulic boost-off approach – A maneuver in which a hydraulic boost malfunction is simulated, thus allowing the pilot to practice the emergency procedure in a perfectly functioning aircraft.

Indicated Airspeed (IAS) – The airspeed read directly from the airspeed indicator (ASI) on an aircraft, driven by the pitot-static system. It either uses the difference between total pressure and static pressure provided by the system to mechanically or electronically measure dynamic pressure.

Idle, Down, Right, Turn – A mnemonic used to remember the steps to enter a practice autorotation.

Inertia (I) – The property of matter to retain its state of rest or its velocity along a straight line until it is acted upon by an external force.

In Ground Effect (IGE) – A condition in which the helicopter's close proximity to the ground decreases the power required to maintain altitude.

Kinetic Energy (KE) – The energy of a system because of motion. Kinetic energy is part of the helicopter's total energy.

Lag – The momentary loss or gain of NR when a rapid collective movement is made.

Landing criteria – The NATOPS defined courses of action that must be taken in the event of certain emergencies.

Lateral axis – An axis going from side to side of an aircraft passing through the CG and perpendicular to the longitudinal and vertical axes.

Lift – The force derived from an airfoil that acts at right angles to the relative airflow.

Load – The forces acting on a structure and. These may be static (as with gravity), dynamic (as with centrifugal force), or a combination of static and dynamic.

Load factor – The sum of the loads on a structure, including the static and dynamic loads; expressed in units of G.

Lock, Talk, Squawk, Landing Checklist – A mnemonic used to remember the tasks that should be completed during a non-engine failure emergency.

Lock, Talk, Squawk, Restart – A mnemonic used to remember the tasks that should be completed during an autorotative descent following an engine failure.

Longitudinal acceleration – Acceleration substantially along the longitudinal axis of an aircraft.

Longitudinal axis – A straight line through the CG running from the nose to the tail of an aircraft and perpendicular to the lateral and vertical axes. It is the axis about which rolling action occurs.

Loss of Tail Rotor Effectiveness (LTE) – A sudden reduction in tail rotor efficiency that occurs when the wind strikes the aircraft from certain sectors.

Low RPM recovery – An instructor under training maneuver that enables future instructors to practice recovering from a low NR condition during a practice autorotation.

Maintenance control – The personnel who track the work being done on aircraft and aircraft inspections. They also ensure that aircraft are safe for flight and issue aircraft to flight crews.

Malfunction of the fuel control system – A maneuver in which a fuel control malfunction is simulated, thus allowing the pilot to practice the emergency procedure in a perfectly functioning aircraft.

Maneuver – Any planned motion of an aircraft in the air or on the ground.

Maximum glide autorotation – A maneuver that demonstrates the effect of differing airspeeds on the distance a helicopter can cover in an autorotative descent.

Maximum load takeoff – A transition to forward flight in which the helicopter remains in ground effect until achieving translational lift, thereby reducing the power required to complete the transition.

Maximum range cruise airspeed – The airspeed required to achieve the maximum range.

Mean Sea Level (MSL) – the average level of the surface of the Earth's bodies of water from which heights and altitudes may be measured.

Mishap – A serious aircraft incident resulting in significant damage to the aircraft, serious injury, or death.

Moment (M) – Created when a force is applied at some distance from an axis and tends to produce rotation about that point. A moment is a vector quantity equal to a force (F) times the distance (d) from the point of rotation on a line that is perpendicular to the applied force vector. This perpendicular distance is called the moment arm. Torque (Q) is another word for a moment created by a force. $\mathrm{M} = \mathrm{F} \times \mathrm{d}$

Newton's First Law of Motion – "Objects in motion will remain in uniform motion in a straight line unless compelled to change by an outside force."

Newton's Third Law of Motion – The law of interaction: "For every action, there is an equal and opposite reaction."

No hover landing – A maneuver that enables the pilot to transition from an approach directly to landing without establishing a hover first.

No hover takeoff – A maneuver that enables the pilot to transition directly from the ground to forward flight thereby avoiding the dangers of a degraded visual environment.

Normal approach – A maneuver that enables the pilot to transition from cruise flight to a hover over a desired point.

Normal climb – A coordinated maneuver in which the aircraft increases altitude.

Normal cruise – The maneuver used to fly the aircraft from one point to another.

Normal descent – A coordinated maneuver in which the aircraft decreases altitude.

Obstacle clearance takeoff – A precision maneuver that allows pilots to climb vertically prior to transitioning to forward flight in order to avoid an obstacle in the flight path while minimizing time in the avoid region of the H-V Diagram.

Out of Ground Effect (OGE) – A condition in which the helicopters altitude above the ground is great enough that the power required to maintain altitude is not affected by the surface of the Earth. Opposite of In Ground Effect.

Over controlling – Making control inputs that are too large for the desired change in aircraft attitude.

Pendulum effect – The un-commanded nose-up tendency during deceleration that occurs in response to an increase in collective pitch before mechanical and virtual axes are realigned. Compensated for by pilot-induced feathering through forward cyclic.

Pilot error – A mistake made by a pilot that results in an undesired aircraft state, hazard, or mishap.

Pilot Induced Oscillations (PIO) – Repetitive changes in aircraft attitude around an axis caused by the pilot over controlling and then over correcting.

Pitching – The movement of the aircraft around its lateral axis.

Potential Energy (PE) – The energy of a system derived from position. Potential energy is part of helicopter’s total energy. It is due to the height above a surface, which is the helicopter altitude. It is defined as PE = mgh (mass × gravity × height).

Power (P) – The rate of doing work; often expressed in units of hp.

Power, Attitude, Trim – A mnemonic that reminds aviators in what order to make control inputs when changing the aircraft condition.

Power Available (PA or Pavail) – The amount of power an engine is capable of producing for given conditions. As DA increases, engine power available decreases.

Power excess/excess power – The ratio of power available to the power required. If the ratio is less than one then power required exceeds the power available.

Power off wave-off – A maneuver that enables a pilot to terminate a simulated engine failure or autorotative descent and transition to a normal climb or forward flight.

Power on wave-off – A maneuver that enables the pilot to terminate an approach or landing and transition back to forward flight.

Power, Pedal, Pause, Trim, Turn – A mnemonic used by pilots to remember the correct steps when initiating a descent from the 180º position of an approach.

Power recovery autorotation – A practice autorotation in which the pilot returns the twist grip to the flight position during the flare and terminates the maneuver in a hover taxi.

Power Required (PR or Preq) – The amount of power necessary to turn the rotor system at a constant speed. As the DA increases, the pitch angle of the rotor blades must increase to generate the same amount of lift. This creates more drag forces on the rotor system and therefore more power is required to maintain a constant rotor speed.

Practice autorotation – A maneuver in which the pilot deliberately moves the twist grip to flight idle in order to practice maneuvering in an autorotative descent and autorotative landings.

Press, Set, Stabilize, Release – A verbal ditty to remind pilots the proper method of trimming the helicopter.

Pressure Altitude (PA) – The altitude of a given pressure in the standard atmosphere. See Standard atmosphere. As pressure increases, density increases, and DADA decreases. PA can be easily determined by setting the altimeter setting to 29.92 in Hg and read PA directly from the altimetry.

Pull, Pause, Level – A mnemonic to remind pilots of the flight control inputs that must be made at during an autorotative landing.

Radio Magnetic Indicator (RMI) – An aircraft instrument that shows the aircraft's magnetic heading.

Rate of Climb (ROC) – The rate at which an aircraft gains altitude. It is the vertical component of the aircraft speed in climbing.

Rate of Descent (ROD) – The rate at which an aircraft descends. It is the vertical component of the aircraft speed in descending.

Rate of turn – The rate at which an aircraft changes heading.

Relative wind – Represents all the wind an aircraft experiences.

Roll – The movement of the aircraft around its longitudinal axis.

Rotational Energy (RE) – The energy of a system derived from a mass in rotation. Rotational energy is part of the helicopter's total energy, and it is due to the main rotor rotating mass; rotors RPM. It is defined as RE = ½ IΩ2 (1/2 inertia of blades × rotor RPM squared).

Rotor disk – The area of the circle inscribed in the tip path plane.

Scan – The pilot's act of looking outside at specific indications and cross checking the flight instruments to ensure that the desired flight parameters are maintained.

Set (constant) power climb – A maneuver that demonstrates the relationship between altitude and airspeed as well as potential and kinetic energy without changing the power setting of the aircraft.

Set (constant) power descent – A maneuver that demonstrates the relationship between altitude and airspeed as well as potential and kinetic energy without changing the power setting of the aircraft.

Set power turn – A maneuver that demonstrates the relationship between altitude and airspeed while turning without adjusting the power setting of the aircraft.

Settling – A condition in which the aircraft's altitude begins to decrease because the current power being generated by the engine is not sufficient to maintain altitude at the given airspeed.

Shallow approach – A maneuver that enables the pilot to transition from cruise flight to a hover or sliding landing using a shallower than normal glideslope.

Simulated engine failure at altitude – A maneuver in which an engine failure is simulated while at altitude, thus allowing the pilot to practice the emergency procedure in a perfectly functioning aircraft. Simulated engine failures at altitude may terminate in a power recovery autorotation, full autorotation, or a power off wave-off.

Simulated engine failure in a hover and hover taxi (cut gun/taxi cut gun) – A maneuver in which an engine failure is simulated in a hover or hover taxi, thus allowing the pilot to practice the emergency procedure in a perfectly functioning aircraft.

Simulated engine failure on takeoff – A maneuver in which an engine failure is simulated shortly after transitioning to forward flight, thus allowing the pilot to practice the emergency procedure in a perfectly functioning aircraft. Simulated engine failures on takeoff terminate in a power recovery autorotation.

Simulated fixed pitch pedal position at altitude – A maneuver in which a stuck tail rotor malfunction is simulated, thus allowing the pilot to practice the emergency procedure in a perfectly functioning aircraft.

Single axis inputs in a hover – A series of maneuvers which demonstrate how the helicopter will respond if a single flight control is moved while in a hover.

Single axis inputs in forward flight – A series of maneuvers which demonstrate how the helicopter will respond if a single flight control is moved while in forward flight.

Sliding landing – A maneuver that enables the pilot to transition from an approach to landing while maintaining translational lift until the aircraft is in ground effect, thereby reducing the power required to land the helicopter.

Speed – The rate at which an object moves in relation to time and distance.

Square patterns – Precision maneuvers performed in a hover using references outside the cockpit.

Stability Augmentation System (SAS) Off – A maneuver in which a SAS malfunction is simulated, thus allowing the pilot to practice the emergency procedure in a perfectly functioning aircraft.

Steep approach – A maneuver that enables the pilot to transition from forward flight to a hover or no hover landing using a steeper than normal glideslope.

Tail rotor – The anti-torque device of a single-rotor helicopter. Control of this rotor is through the foot pedals.

Tail strake – This L shape aerodynamic component usually protrudes about an inch on the side of the tail boom and runs for the entire length of the tail boom. A tail strake acts like a spoiler. It aerodynamically augments the authority of the tail rotor in hover and at slow speeds.

Taxi – The operation of an airplane or helicopter under its own power on the ground, except that movement incident to actual takeoff and landing. The forward movement of a helicopter at a hover is referred to as a hover taxi or air taxi, depending on speed and altitude.

Taxi cut gun – see Simulated Engine Failure in a Hover and Hover Taxi

Temperature (T) – A measure of the average kinetic energy of air particles. As temperature increases, particles begin to move and vibrate faster, increasing their kinetic energy. Air temperature decreases linearly with an increase in altitude at a rate of approximately 2 °C (3.57 °F) per 1,000 feet up through 36,000 feet MSL. This is called the standard or adiabatic lapse rate. Above 36,000 feet lies the isothermal layer where air is at a constant temperature of -56.5 °C.

Throttle – See Twist Grip.

Tip path – The path described by the tips of the rotor blades.

Tip path plane – The plane (disk) within the tip path. It is parallel to the plane of rotation. The tip path plane contains the rotor disk, and rotor thrust is perpendicular to the tip path plane.

Torque – Force times a distance. It causes the fuselage to react in yaw because the drive train turns the rotor.

Torque effect – In a counterclockwise single main rotating rotor system, due to the momentum of the advancing rotor blade on the right side of the aircraft, there is an equal and opposite reaction (torque), which causes the helicopter to rotate to the right.

Total energy – The energy stored in the helicopter and is the result of adding – (a) Potential Energy (PE), due to the height above a surface; Helicopter Altitude. (b) Kinetic Energy (KE), due to the motion with respect to a point on the ground; Helicopter Groundspeed. (c) Rotational Energy (RE), due to the main rotor rotating mass; Rotors RPM.

Total Rotor Thrust (TRT) – The force created by a rotor at right angles to the plane of rotation of the rotor disk. This force acts through the rotor head and is broken up into a vertical component that opposes the weight of the helicopter and a horizontal component that pulls the helicopter through the air.

Translating tendency – The tendency for a helicopter to translate laterally due to tail rotor thrust.

Transition to forward flight – A maneuver that enables the pilot to start in a hover and move to forward flight at the desired pattern or cruise airspeed.

Translational flight – Any horizontal movement of a helicopter with respect to the air.

Translational lift – The increased efficiency of the rotor system in the production of lift by increasing the horizontal mass flow of air through the rotor disk, reducing the induced flow and vortices. See "Effective translational lift."

Trim – The condition of a heavier-than-air aircraft in which it maintains a fixed attitude with respect to the wind axes, with the moments about the aircraft axes being in equilibrium. The word "trim" is often used with special reference to the balance of control forces.

Turbulence – An agitated condition of the air or other fluids. A body in motion through the air can create a disordered, irregular, mixing motion of air called air turbulence.

Turn rate indicator and ball – Instruments that show how fast the aircraft is changing heading and whether or not the aircraft is balanced flight.

Twist grip (throttle) – The control that enables the pilot to control the fuel flow to the engine. It is used during start-up, shutdown, and to set the flight idle and flight positions.

Vector – A quantity having both magnitude and direction. A graphic illustration of a quantity having both magnitude and direction.

Velocity – The time rate of motion in a given direction. It is a combination of speed and direction. It is represented by a vector quantity that includes both magnitude (speed) and direction relative to a given frame of reference.

Vertical axis – A straight line through the CG running from top to bottom and perpendicular to the longitudinal and lateral axis. It is the axis about which yaw occurs.

Vertical landing – A maneuver that enables a pilot to lower the helicopter onto the ground from a stable hover.

Vertical takeoff – A maneuver that enables a pilot to takeoff from the ground and establish a stable hover.

Vertical speed indicator – Aircraft instrument that show the rate at which the aircraft is climbing or descending.

Vortex Ring State (VRS) – The settling of the helicopter into its own downwash. During VRS, airflow is downward over the outer portion of the rotor disk and upward in both an area expanding outward from the hub as well as the area outside the tip path plane. This rapidly decaying phenomenon may result in zero net lift, high vibrations, and high sink rates/rates of descent.

Vuichard Recovery – A method of recovering from VRS in which the pilot smoothly increases power while applying left pedal and right cyclic to slide out of the downwash.

Weathervane effect – The tendency of a helicopter to face into the wind while in a hover, air taxing, or slow flying.

Weight (W) – A measure of the mass of an object under the acceleration of gravity.

Work (W) – A force exerted over a given distance. Work is done when a force acts on a body and moves it. It is a scalar quantity equal to the force (F) times the distance of displacement (s).
$W = F \times s$

Yaw – The movement of the aircraft around its vertical axis.

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APPENDIX B
SOLO GUIDELINES

Attention to detail and awareness of procedures are essential to safe flight, especially during the execution of a solo flight.

Solo Observer Responsibilities

After successfully completing the check ride, you are eligible to be assigned as an observer for another student on his/her familiarization solo. On your check ride brief, you and your Instructor will discuss solo observer responsibilities. Review these procedures prior to the preflight brief, and be prepared to discuss these responsibilities with your Instructor.

Preflight Brief

1. Student crew should brief prior to seeing Operations Duty Officer (ODO)/Flight Duty Officer (FDO) per squadron SOP.

2. Following FDO/ODO brief, conduct a crew brief with the student pilot.

Aircraft Issue

– Assist the student pilot in reviewing the Aircraft Discrepancy Book (ADB) for your aircraft. Ensure you do not have any down pink sheets and the aircraft is released safe for flight. If unclear or confused over any discrepancy or signoff to your satisfaction, ask another Instructor or call the FDO/ODO for clarification or guidance. For dual solo flights, sign two acceptance cards, one for each solo, and complete one Electronic Flight Record (EFLIR) for the combined event.

Preflight Inspection

– Assist the student pilot in the preflight inspection to the best of your ability. If unclear or confused over any discrepancy, ask another Instructor or call the troubleshooter for clarification.

Prestart Checklist

1. Challenge the student pilot to checklist items and ensure the student pilot not only responds correctly, but also performs the function correctly.

2. Ensure the doors are secure.

Start Checklist

– Challenge the student pilot to checklist items and ensure the student pilot not only responds correctly, but also performs the function correctly.

Pre-Takeoff Checklist

1. Challenge the student pilot to checklist items and ensure the student pilot not only responds correctly, but also performs the function correctly.

2. During the control check, caution the student pilot against rapid or large flight control movements.

3. Caution the student pilot when he/she opens the twist grip not to exceed 30 percent torque.

Takeoff Checklist

1. Challenge the student pilot to checklist items and ensure the student pilot not only responds correctly, but also performs the function correctly.

2. Tune radios as directed by student pilot.

3. Clear left prior to liftoff.

4. Ensure position lights are on STEADY BRIGHT.

On Initial Liftoff/Flight Line Taxiing

1. Check CAS messages and instruments normal.

2. Clear left as necessary.

3. Do not allow the student pilot to taxi upwind of any aircraft starting up or shutting down (low RPM, anti-collision lights ON) or taxi by any fuel truck closer than 50 feet.

4. Remember, the HOLD signal given by any line personnel is a mandatory STOP!

5. Be alert while taxiing, looking for pedestrians, other taxiing aircraft, ground support vehicles, fuel trucks, Foreign Object Damage (FOD), open doors on other parked aircraft, etc.

6. Clear left at all intersecting/converging avenues of taxi.

7. Tune radios/transponder as directed.

After Takeoff

1. Provide clearing voice reports as necessary.

2. Monitor CAS messages.

3. Ensure your aircraft is clear of the maintenance pattern/traffic. Be alert for Ground Controlled Approach (GCA) traffic when crossing the approach end of runway 32.

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NOTE

> The maintenance pattern is oriented about the duty runway, flown in a racetrack pattern, within the confines of the upwind and downwind ends of the duty runway.

En route

1. Keep alert for other aircraft entering the channel.

2. Clear left as necessary.

3. Tune radio as required.

4. Remind student pilot to perform landing checklist.

At the Site

1. Do not let the student pilot put you in extremis. If the student pilot performs any maneuver you deem unsafe or imminently dangerous, express your concern before it is too late. Communicate! At no time will you assume control of the helicopter.

2. If the student pilot chooses the left pattern, you are primarily responsible for clearing the aircraft prior to turning crosswind. Choosing the right pattern does not relieve you of primary responsibility for clearing the aircraft. After clearing yourself left, double check the student pilot and ensure you are cleared right.

NOTE

> Check above your position, at your altitude, and most importantly, below and behind near your six o'clock position. Traffic in the 180-degree lane is difficult to see and converges on your crosswind turn position at a rapid rate. Be alert!

Practicing Low Work

1. Abbreviated low work may be practiced.

2. If winds are above 20 KTS, remind the student pilot of the effects of the wind while practicing square patterns and turns on the spot.

Emergencies

1. Pull the checklist and read the correct procedural steps to the student pilot. Ensure the student pilot performs the proper steps in sequence.

2. Do not allow the student pilot to rotate the twist grip to flight idle or the secure position unless both agree that an autorotation is the proper course of action!

WARNING

> Do not enter an autorotation because a land as soon as possible caution light illuminates. As long as the engine is developing power, maintain N1/NR and make a power on approach to the nearest safe landing site.

3. Perform landing checklist, squawk 7700, and broadcast a MAYDAY/PAN report.

4. When on the deck, report over UHF, "Safe on Deck," and proceed with the Emergency Shutdown Checklist.

5. At the site, advise the weather pilot/solo watch of your position/difficulty as soon as possible.

Hot Seat

1. Ensure the student pilot has retarded the twist grip to flight idle before allowing any personnel to enter or leave the rotor arc.

2. Hold the controls while the student pilot and maintenance/Instructor execute the seat change.

Returning from the OLF

1. Leave the OLF with no less than 350 lbs.

2. Keep alert for other aircraft entering the channel.

3. Clear left as necessary.

4. Tune radios as required.

5. Remind student pilot to perform landing checklist.

6. Be alert for maintenance and GCA traffic when approaching home field.

7. If unsure of any tower transmission, do not hesitate to ask for clarification.

Closing out NAVFLIRS

A Naval Aviation Flight Records (NAVFLIRS) accurately reflecting the solo flight time must be completed. If two solo students share the same aircraft, there will be one NAVFLIRS generated with each student logging the appropriate amount of first pilot time.

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