FLIGHT TRAINING GUIDE
CHAPTER 9

R66 MANEUVER GUIDE

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R66 MANEUVER GUIDE

INTRODUCTION

The intention of this guide is to aid both the student and instructors while conducting training in the R66. It should be understood that because of the many variables in geographic location, altitudes, loading and individual instructor techniques, minor modifications to certain maneuvers might be necessary. For the purposes of training, the following parameters should be adhered to.

Normal Climb	60 kts
Normal Cruise	90–110 kts
Hovering	5 feet
Takeoffs	Hover power
Autorotative Descents	60–70 kts
Maximum Hover Speed—Forward	10 kts groundspeed
Maximum Hover Speed—Lateral/Rearward	5 kts groundspeed

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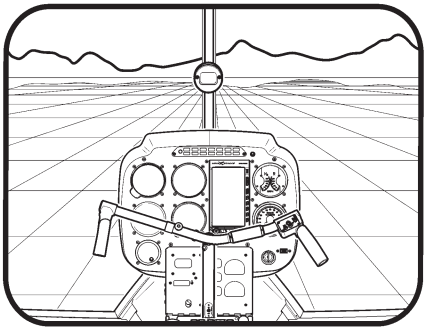
STRAIGHT AND LEVEL FLIGHT

PURPOSE:

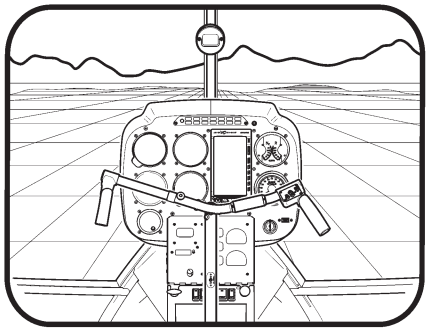
To fly the helicopter at a constant airspeed, altitude, and heading.

DESCRIPTION:

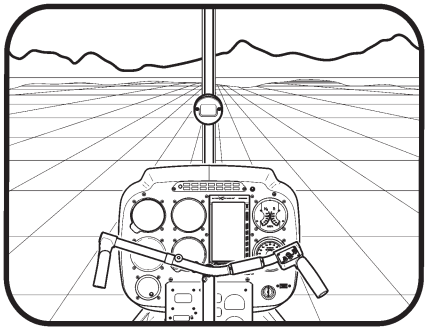
Attitude or pitch control with the cyclic is the most important aspect of straight and level flight. A level flight attitude is best determined by referencing the horizon with a fixed point in the cockpit, such as the magnetic compass or the tip path plane. The pilot will be able to detect changes in attitude by noting changes between the fixed point and the horizon. Airspeed is determined by attitude and controlled by the cyclic. As in all helicopters, the R66 cyclic control is very sensitive and requires very slight pressure to effect a change. Normal cruise airspeed for training is 90 KTS.



Level Flight Attitude
Constant Airspeed



Nose High Attitude
Airspeed Decreases



Nose Low Attitude
Airspeed Increases

Altitude is controlled primarily by the collective. Each collective movement will require a corresponding pedal adjustment to maintain the aircraft in trim. An increase of collective will require left pedal. A collective decrease will require right pedal. Additionally, when the collective is increased, the nose will tend to rise, requiring slight forward cyclic to maintain a level or cruise flight attitude. The opposite is true with a decrease in collective—the nose will move down, requiring a slight aft cyclic.

PERFORMANCE STANDARDS:

	Private	Commercial
Airspeed	± 10 KTS	± 5 KTS
Altitude	± 100 feet	± 50 feet
Heading	± 10°	± 5°

NORMAL CLIMBS AND DESCENTS

PURPOSE:

To change altitude at a controlled rate in a controlled attitude.

DESCRIPTION:

Climbs

For training purposes, climb airspeed is 60 KTS at 500 feet per minute rate of climb. From straight and level flight at 90 KTS, clear above the aircraft. Initiate the climb by raising the collective to climb power (a torque setting which will provide a 500 ft/min climb at 60 KTS). Maintain aircraft trim with a slight amount of left pedal and apply aft cyclic to adjust the attitude to a "60 KT climb attitude". 50 feet prior to reaching the level-off altitude, begin the level off by lowering the nose to a 90 KT attitude with forward cyclic, lowering the collective slowly to cruise power (a torque setting for level flight at 90 KTS). Maintain aircraft trim with right pedal. Throughout the climb and level-off, continually crosscheck outside references—(attitude and heading) with inside references—(flight instruments).

Descents

For training purposes, descent airspeed is 60 KTS at 500 feet per minute rate of descent. From straight and level flight at 90 KTS, clear below the aircraft. Initiate the descent by lowering the collective to a torque setting that will provide a 500 feet per minute descent at 60 KTS. Maintain aircraft trim with a slight amount of right pedal. Apply aft cyclic to adjust the attitude to a "60 KT attitude". 50 feet prior to reaching the level-off altitude, begin the level-off by raising the collective slowly to cruise power (torque). Maintain aircraft trim with left pedal. Apply forward cyclic to adjust the attitude to a level flight attitude. Throughout the descent and level-off, continually crosscheck outside references—(attitude and heading) with inside references—(flight instruments).

PERFORMANCE STANDARDS:

	Private	Commercial
Airspeed	± 10 KTS	± 5 KTS
Level-off Altitude	± 100 feet	± 50 feet
Heading	± 10°	± 5°

TURNS

PURPOSE:

To turn the aircraft using a constant angle of bank at a constant airspeed and altitude.

DESCRIPTION:

From straight and level flight at 90 KTS, clear the aircraft in the direction of turn. Smoothly apply cyclic towards the direction of turn until the desired angle of bank is reached. Unlike an airplane, the pedals should not be used to assist the turn. Use the horizon as a reference to maintain a "90 KT attitude" and desired angle of bank with cyclic. As the angle of bank increases, additional collective may be required to maintain altitude. Keep the aircraft in trim with the pedals. Begin the recovery from the turn just prior to reaching the desired rollout heading. Apply cyclic opposite the direction of turn, and if any collective has been added during the turn, reduce it back to cruise power, while maintaining aircraft trim.

PERFORMANCE STANDARDS:

	Private	Commercial
Airspeed	± 10 KTS	± 5 KTS
Altitude	± 100 feet	± 50 feet
Roll out Heading	± 10º	± 5º

ACCELERATION / DECELERATION

PURPOSE:

To increase pilot control co-ordination. Maintaining a constant altitude, accelerate to 110 KTS, decelerate to 60 KTS, and then accelerate back to 90 KTS.

DESCRIPTION:

From straight and level flight at 90 KTS, slowly raise the collective approximately 10% torque above cruise power, adding left pedal and forward cyclic. As the aircraft begins to accelerate, adjust cyclic, collective and pedals as necessary to stabilize at 110 KTS and level flight. Begin the deceleration by slowly lowering the collective co-coordinated with right pedal and aft cyclic. Again, use all controls slowly and smoothly as necessary to decelerate to 60 KTS and level flight. Accelerate back to 90 KTS by raising the collective to cruise power, left pedal and forward cyclic to attain level flight at 90 KTS.

Throughout the maneuver, a constant crosscheck of airspeed, altitude, attitude and trim must be maintained.

PERFORMANCE STANDARDS:

	Private	Commercial
Airspeed	± 10 KTS	± 5 KTS
Altitude	± 100 feet	± 50 feet
Heading	± 10°	± 5°

TAKEOFF TO A HOVER

PURPOSE:

To transition from the ground to a stabilized 5-foot hover.

DESCRIPTION:

After completing a pre-takeoff check (Annunciator panel lights off, RPM 100%, instruments in the green, fuel, and transponder), clear the helicopter left and right. With the collective full down and the cyclic and pedals neutralized, slowly raise the collective adding a small amount of left pedal to compensate for the increased torque. As the helicopter becomes light on the skids, select a reference point 50 to 75 feet in front of the helicopter and neutralize all aircraft movement with the cyclic and pedals. Continue to raise the collective smoothly and slowly, maintaining heading with slight pedal corrections. Since the R66 normally hovers in a nose high, left rear skid low attitude with two occupants, the toes of the skids will break ground first and the left rear skid last. Compensate with forward and right cyclic. As the helicopter becomes light on the skids, extreme caution must be used to avoid any rearward or lateral movement since this can cause a dynamic rollover. Should any lateral or rearward movement occur, immediately lower the collective and begin again. The helicopter should rise vertically, maintaining heading with pedals (note the pedals are slightly more sensitive than the R44), position over the ground with cyclic, and altitude with the collective. After attaining a stabilized 5-foot hover, perform hover check:

1. RPM—100% (beep if necessary)
2. Engine instruments—green range
3. Hover power—note torque
4. Center of gravity—note cyclic position

PERFORMANCE STANDARDS:

	Private	Commercial
Altitude	± 2 feet	± 1 foot
Heading	± 10°	± 5°
Position	10′ Circle	5′ Circle

LANDING FROM A HOVER

PURPOSE:

To land the helicopter from a 5-foot hover.

DESCRIPTION:

From a stabilized 5-foot hover, headed into the wind, slightly lower the collective to establish a slow rate of sink. A small amount of right pedal will be needed to maintain heading. The cyclic will be used to maintain position over the ground. Vision should be directed 50–75 feet in front of the helicopter. Do not look immediately in front of the helicopter, as this will lead to over controlling.

As the helicopter descends to about 6 inches, additional downward pressure on the collective may be necessary to overcome the increase in ground effect. As the skids make ground contact, neutralize all aircraft movement with cyclic and pedals, continuing to smoothly lower the collective until it is full down. Due to the nose high attitude of the R66 with two people aboard, the left rear skid will normally touch first on level terrain. A slight amount of forward and right cyclic will be necessary as ground contact is made.

CAUTION

Do not allow the helicopter to land with any rearward or sideward movement.

PERFORMANCE STANDARDS:

	Private	Commercial
Heading	± 10°	± 5°
Drift	4 feet	2 feet

HOVERING FLIGHT

PURPOSE:

To maneuver the helicopter forward, sideward, rearward and turn the aircraft while hovering.

DESCRIPTION:

Forward, sideward and rearward flight

From a stabilized 5-foot hover, headed in to the wind, move the cyclic smoothly towards the desired direction of flight. Maintain heading with small pedal corrections and altitude with collective. As movement begins, adjust the cyclic to keep the groundspeed at a constant rate equivalent to a normal walk. Reference points along the direction of flight can be used to maintain correct ground track. To stop the movement, apply cyclic opposite to the direction of movement until the helicopter stops. During all phases of hovering, cyclic changes should be small and smooth to minimize the effects of over controlling or pendular action.

Crosswind hovering is accomplished in much the same manner. The cyclic must be inclined into the wind enough to cancel out any tendency for the helicopter to drift.

Hovering Turns

Hovering turns are accomplished by use of the pedals. With the helicopter headed into the wind, apply pedal in the desired direction of turn. As the helicopter turns, counter pressures on the opposite pedal should be used to maintain a slow, constant rate of turn. (A rate of 360° in 15 seconds is recommended.)

Cyclic is used to control attitude and position over the ground and should be continually adjusted into the wind to avoid drifting and excessive attitude changes during the turn. Maintain a constant altitude with the collective. Normally, a slight altitude loss will occur in a left turn due to the increased pitch of the tail rotor blades. This can be corrected with a slight increase in collective. Right turns produce just the opposite effect. A decrease in the tail rotor pitch will cause a slight increase in altitude. If necessary, compensate by slightly lowering the collective. As the desired heading is reached, stop the turn by applying slight pressure on the opposite pedal.

PERFORMANCE STANDARDS:

	Private	Commercial
Altitude	± 2 feet	± 1 foot
Heading	± 10°	± 5°
Ground Track	± 5 feet	± 3 feet

TRAFFIC PATTERN OPERATIONS

PURPOSE:

For training purposes, traffic pattern operations are used for the practice of continual takeoffs and landings.

DESCRIPTION:

Upwind Leg

After takeoff, assume a normal climb at 60 KTS. Upon reaching a predetermined point on the ground, begin a 90° turn to crosswind.

Crosswind Leg

Maintain ground track by crabbing the helicopter into the wind. 50 feet prior to reaching 500 feet AGL, begin a level-off by accelerating slowly to 75 KTS and reducing the power to cruise power. Upon reaching a predetermined point on the ground, begin a 90° turn to downwind.

Downwind Leg

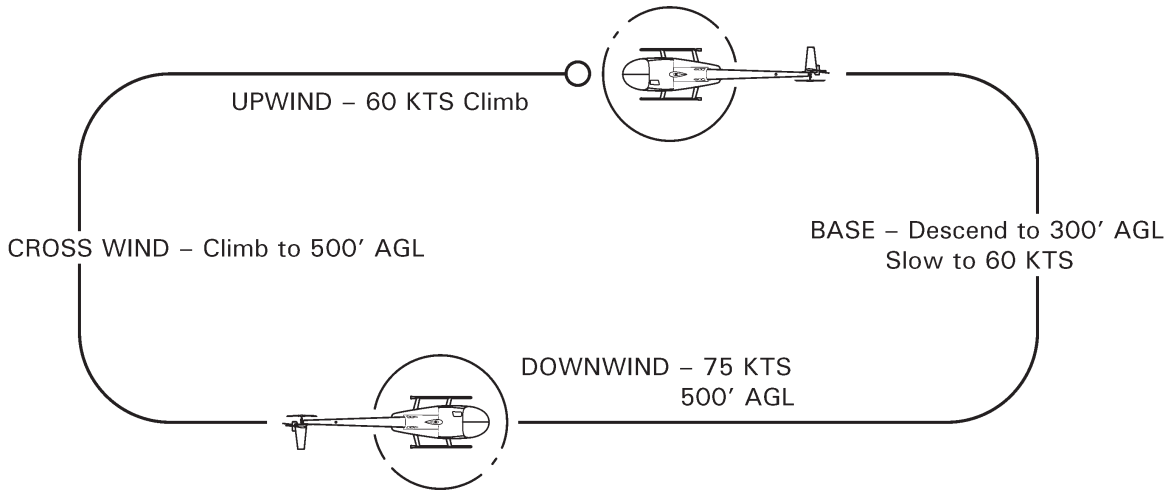
Complete a pre-landing check (Annunciator panel lights off, RPM 100%, instruments in the green and fuel). Groundspeed will increase due to the downwind condition. Fly the downwind leg at 75–90 KTS (depending on the size of the pattern) and 500 feet AGL using ground reference points to maintain ground track. Upon reaching a predetermined point on the ground, lower the collective to establish a descent. Once the descent is established, begin a 90° turn and start decelerating to 60 KTS. This turn will require a steeper angle of bank due to the downwind condition.

Base Leg

On base, descend to 300 feet AGL and slow to 60 KTS. Plan the turn from base to final so as to roll out aligned with the point of intended touchdown.

Final

Fly the final approach leg at 60 KTS and 300 feet AGL until the appropriate approach angle is reached.



TRAFFIC PATTERN OPERATIONS (cont'd)

PERFORMANCE STANDARDS:

	Private	Commercial
Airspeed	± 10 KTS	± 5 KTS
Altitude	± 100 feet	± 50 feet

NORMAL TAKEOFF FROM A HOVER

PURPOSE:

To transition from a hover to a normal climb.

DESCRIPTION:

From a stabilized 5-foot hover, select an object(s) along the takeoff path for use as a reference point to maintain ground track.

Clear the aircraft left and right with a clearing turn, then complete a pre-takeoff check (Annunciator panel lights off, RPM 100%, instruments in the green, fuel and transponder).

Begin the takeoff with a small amount of forward cyclic to get the helicopter moving forward. If the helicopter begins to settle, raise the collective as necessary to hold altitude and maintain heading with pedals.

As the airspeed increases to approximately 10–12 KTS, effective translational lift (ETL) will occur, and can be felt as a lateral vibration.

At ETL, lift will increase noticeably causing the nose to pitch up. Apply sufficient forward cyclic to continue the acceleration and prevent the nose from rising.

As airspeed increases, the streamlining of the fuselage and the increased efficiency of the tail rotor will cause a left yaw, requiring a right pedal correction. Continue to smoothly accelerate, maintaining ground track.

At an altitude of 300 feet and airspeed of 55 KTS, adjust torque to climb power and slight aft cyclic to establish a 60 KT climb attitude.

CROSSWIND CONSIDERATIONS:

During crosswind takeoffs, the helicopter is flown in a slip to an altitude of 50 feet. Place the cyclic into the wind as necessary to maintain the proper ground track. Apply opposite pedal to align the fuselage with the ground track. Above 50 feet, crab the helicopter into the wind by putting the aircraft in trim and maintaining ground track with cyclic.

NOTE

During the takeoff, the acceleration to climb speed and the commensurate altitude gain should be accomplished without entering the shaded areas of the R66's height-velocity diagram.

PERFORMANCE STANDARDS:

	Private	Commercial
Drift below 10 feet	± 25 feet	± 10 feet
Drift above 10 feet	± 50 feet	± 25 feet

NORMAL APPROACH TO A HOVER

PURPOSE:

To transition from flight at altitude to a stabilized 5-foot hover.

DESCRIPTION:

On final approach, the helicopter should be headed into the wind, aligned with the point of intended touchdown, at 60 KTS and 300 feet AGL. When a normal approach angle of 10° is intercepted, begin the approach by lowering the collective sufficiently to get the helicopter descending down the approach angle. With the decrease in collective, the nose will tend to pitch down, requiring aft cyclic to maintain a 60 KT attitude and right pedal to maintain heading. The pilot can determine the proper approach angle by relating the point of intended touchdown to a point on the helicopter windshield. The collective controls the angle of approach. If the touchdown point seems to be moving up on the windshield, the angle is becoming shallower, necessitating a slight increase in collective. If the touchdown point moves down on the windshield, the approach angle is becoming steeper, requiring a slight decrease in collective. The cyclic is used to control the rate of closure or how fast you are moving toward the touchdown point.

Maintain entry airspeed until the apparent groundspeed and rate of closure appear to be increasing. At this point, slowly begin decelerating with slight aft cyclic, maintaining the approach angle by smoothly reducing the collective. Use the cyclic to maintain a rate of closure equivalent to a brisk walk. At approximately 25–40 feet, depending on wind, the helicopter will begin to lose effective translational lift. This loss will be felt as a lateral vibration and the aircraft will begin to settle. The pilot must anticipate the loss of ETL, and compensate with increased collective to maintain the approach angle. The increase of collective will tend to make the nose rise and yaw to the right requiring forward cyclic and left pedal to maintain proper rate of closure and heading. As the helicopter approaches an altitude of 5 feet, the collective should be raised sufficiently to hold a 5-foot hover, maintaining heading with pedals. A small aft cyclic input may be necessary to stop any forward movement.

CROSSWIND CONSIDERATIONS:

During the approach, maintain a crab into the wind and the aircraft in trim. At 50 feet of altitude, a slip should be used to align the fuselage with the ground track. Apply cyclic into the wind and opposite pedal.

PERFORMANCE STANDARDS:

	Private	Commercial
Drift above 10 feet	± 50 feet	± 25 feet
Drift below 10 feet	± 25 feet	± 10 feet

MAXIMUM PERFORMANCE TAKEOFF AND CLIMB

PURPOSE:

To transition from the surface to a maximum performance climb, simulating obstruction clearance.

DESCRIPTION:

In the R66 simulate maximum power by using hover power plus 10% torque. Clear the aircraft left, right and overhead, then complete a pre-takeoff check (annunciator panel lights off, RPM 100%, instruments in the green, fuel, and transponder). Select a reference point(s) along the takeoff path to maintain ground track.

Begin the takeoff by getting the helicopter light on the skids. Pause and neutralize all aircraft movement. Slowly raise the collective and position the cyclic so as to break ground and maintain a 40 KT attitude (approximately the same attitude as when the helicopter is light on the skids). Continue to slowly raise the collective until hover power plus 10% torque is reached. This large collective movement will require a substantial increase in left pedal to maintain heading.

At 50 feet of altitude, slowly lower the nose to a normal 60 KT climb attitude. As the airspeed passes 55 KTS, reduce the collective to normal climb power.

PERFORMANCE STANDARDS:

	Private	Commercial
Heading	± 10°	± 5°
Power	± 2%	± 2%

STEEP APPROACH TO A HOVER

PURPOSE:

To transition from flight at altitude to a hover using a steeper than normal approach angle.

DESCRIPTION:

On final approach, the helicopter should be headed into the wind, aligned with the point of intended touchdown, at 60 KTS and 300 feet AGL. When a steep approach angle of 15° is intercepted, begin the approach by lowering the collective to get the helicopter descending down the approach angle and coordinate right pedal for trim. Since this angle is steeper than a normal approach angle, the collective must be reduced more than for a normal approach. As in the normal approach, reference the touchdown point on the windshield to determine changes in the approach angle. Aft cyclic will be required to decelerate sooner than in a normal approach due to the steeper angle and the rate of closure will become apparent at a slightly higher altitude. Maintain a crab above 50 feet, and a slip below 50 feet.

Maintain the approach angle and rate of descent with collective, rate of closure with cyclic, and trim with pedals. Loss of ETL will occur higher during a steep approach requiring an increase in collective to prevent settling, forward cyclic for proper rate of closure, and left pedal for trim. Terminate at a stabilized 5-foot hover.

CAUTION

Avoid high rates of descent at airspeeds below 30 KTS.

PERFORMANCE STANDARDS:

	Private	Commercial
Heading	± 10°	± 5°
Termination	± 10 feet	± 5 feet

STRAIGHT-IN AUTOROTATION WITH POWER RECOVERY

PURPOSE:

To simulate safely landing the helicopter with a complete power loss.

DESCRIPTION:

NOTE

1. **Prior to conducting a practice autorotation, insure an N1 Deceleration Check has been performed in accordance with the R66 Pilot's Operating Handbook.**
2. **Insure the cabin heat is off.**

The Entry

From level flight at 70–75 KTS, 500–700 feet AGL, and headed into the wind, smoothly, but firmly, decrease the throttle to idle applying right pedal to correct for the change in torque. When the throttle is at idle immediately lower the collective full down simultaneously applying aft cyclic to maintain a level attitude. **It is important not to lower the collective until the throttle is at the idle position to prevent an N2 overspeed. Crosscheck attitude, trim, rotor RPM, and airspeed.**

The Glide

After the autorotative decent has been established, slowly reduce the airspeed to 60–70 KTS and maintain this attitude throughout the glide. During autorotative glides, attitude control should be accomplished by reference to the horizon not the airspeed indicator. Maintain rotor RPM between 95% and 100% and the aircraft in trim. Below 100 feet AGL, maintain the aircraft ground track with a slip. A constant 60–70 KT attitude should be held with the cyclic. Avoid looking straight down in front of the aircraft. Continually crosscheck attitude, trim, rotor RPM, and airspeed.

100 FT DECISION CHECK

Prior to the helicopter descending through 100 feet AGL, the instructor should make an immediate power recovery if the following three conditions do not exist:

1. **Rotor RPM stabilized between 95%–100% RPM.**
2. **Airspeed stabilized 60–70 KTS.**
3. **A normal rate of decent, usually less than 1500 FPM.**

(At density altitudes above 4000 feet the Decision Check should be completed prior to descending thru 200 feet.)

The Flare

At approximately 40 feet AGL, begin the flare with aft cyclic to reduce forward airspeed and decrease the rate of descent. The amount of flare will depend on wind conditions and gross weight, and should gradually be increased so that groundspeed and rate of descent are significantly decreased. Too much flare will cause the helicopter to balloon

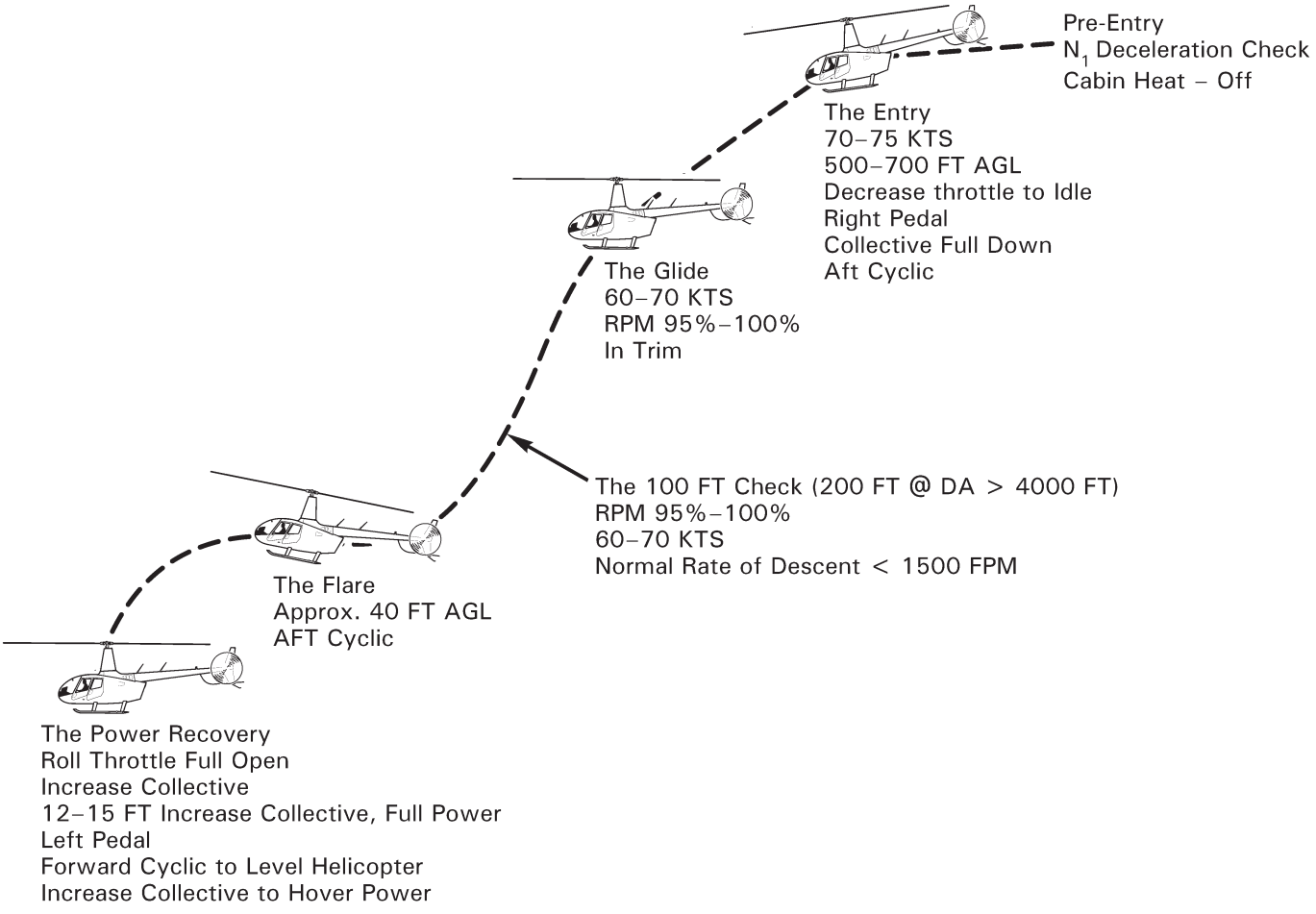
STRAIGHT-IN AUTOROTATION WITH POWER RECOVERY (cont'd)

The Flare (cont'd)

up causing a high vertical descent rate as airspeed is lost and too little flare will not adequately reduce the groundspeed.

The Power Recovery

Due to the inherent lag or delay in the response time of turbine engines, power must be increased much sooner than in a piston helicopter such as the R22 or R44. Just prior to beginning the flare or immediately after initiating the flare, roll the throttle full open then slightly increase the collective to put a load on the engine as it spools up. At approximately 12–15 foot skid height, as the forward speed decreases slowly raise the collective allowing the engine to spool up to full power, maintaining heading with left pedal. Begin to level the helicopter with forward cyclic. Extreme caution should be used to avoid an excessive nose high/tail low attitude below 10 feet. Just prior to achieving a level attitude, with the nose still slightly up, continue to increase the collective to reduce groundspeed and sustain a hover. Slight forward movement as the helicopter comes to a hover is acceptable. Do not allow the helicopter to descend below 5 feet during the power recovery.



STRAIGHT-IN AUTOROTATION WITH POWER RECOVERY (cont'd)

The Touchdown

At the completion of the flare, approximately 5–8 foot skid height, begin to raise the collective to slow the descent rate and decrease the forward speed. At the discretion of the pilot, one of two techniques can be used for increasing the collective. Use either a small, quick “initial pitch pull” immediately followed by a slow “cushioning” increase in collective or one smooth, steady increase of the collective. Unlike the power recovery autorotation, the nose will yaw to the left when the collective is raised due to the friction through the main rotor gearbox and drive train, requiring the need for right pedal to keep the aircraft aligned with the ground track. The most important aspect of the touchdown is to land in a level flight attitude with the skids parallel to the ground track. Landing with the aircraft drifting left or right, skids offset from the ground track or excessively on the “heels” or “toes” of the skid gear can all result in aircraft accidents. Once the aircraft is on the ground the collective can be slowly lowered to act as a brake (assuming the landing is on a hard surface). Aft cyclic should not be used to slow the aircraft on the ground as excessive blade flapping could lead to tail boom contact.

PERFORMANCE STANDARDS:

	Private	Commercial
Predetermined Spot	± 200 feet	± 100 feet
RPM	95%–100%	95%–100%
Airspeed	+10 KTS	± 5 KTS

180º AUTOROTATION WITH POWER RECOVERY

PURPOSE:

To simulate safely landing the helicopter by turning 180º with a complete power loss.

DESCRIPTION:

NOTE

1. **Prior to conducting a practice autorotation, insure an N1 Deceleration Check has been performed in accordance with the R66 Pilot's Operating Handbook.**
2. **Insure the cabin heat is off.**

The Entry

Establish the aircraft on downwind at 75 KTS and a minimum of 700 feet AGL (higher entry altitudes are recommended for initial training). When abeam the intended touchdown point smoothly but firmly, decrease the throttle to idle, applying right pedal to correct for the change in torque. When the throttle is at idle immediately lower the collective full down simultaneously applying aft cyclic to maintain a level attitude. It is important not to lower the collective until the throttle is at the idle position to prevent an N2 overspeed. Crosscheck attitude, trim, rotor RPM and airspeed.

The Glide / Turn

After the descent is established, apply aft cyclic to achieve a 60–70 KT attitude, then roll into a 180º turn. The proper angle of bank will be determined by wind velocity, but use caution to avoid an excessively steep turn, as this will increase the descent rate. Throughout the turn, it is important to maintain the proper attitude (airspeed) and keep the aircraft in trim. Changes in the aircraft's attitude and the angle of bank will cause corresponding increases and decreases in rotor RPM. Adjust the collective as necessary in the turn to maintain rotor RPM between 95%–100%. Continually crosscheck rotor RPM, attitude and trim in the turn. The turn should be completed and the helicopter aligned with the intended touchdown area prior to passing through 100 feet AGL. If the collective has been increased to load the rotor during the turn, it may have to be lowered on roll out to prevent decay in RPM.

100 ft Decision Check

Prior to the helicopter descending thru 100 feet AGL, the instructor should make an immediate power recovery if the following four conditions do not exist:

1. Aircraft aligned with the touchdown point (turn completed).
2. Rotor RPM stabilized between 95%–100%.
3. Airspeed stabilized 60–70 KTS.
4. A normal rate of decent, usually less than 1500 FPM.

(At density altitudes above 4000 feet the Decision Check should be completed prior to descending thru 200 feet.)

180º AUTOROTATION WITH POWER RECOVERY (cont'd)

The Flare

Same as straight-in autorotation.

Power Recovery

Same as straight-in autorotation.

Touchdown

Same as straight-in autorotation.

PERFORMANCE STANDARDS:

	Private	Commercial
Predetermined Spot	± 200 feet	± 100 feet
RPM	95%–100%	95%–100%
Airspeed	+10 KTS	± 5 KTS

POWER FAILURE AT A HOVER—HOVERING AUTOROTATION

PURPOSE:

To simulate landing the helicopter from a hover with a complete power loss.

DESCRIPTION:

Begin from a stabilized 3–5 foot hover over level terrain and headed into the wind. If necessary, reposition the left hand so that the throttle can easily be rolled off. Firmly roll the throttle off to the idle position while simultaneously adding right pedal to maintain heading. The loss of tail rotor thrust will cause a left drift requiring a slight right cyclic correction. Use caution not to raise or lower the collective when rolling off the throttle. As the aircraft settles maintain a level attitude by looking 50–75 feet in front of the aircraft. Due to the N1 deceleration schedule in the turbine engine, the left yaw and descent rate will be less than in a piston engine or in an actual engine failure. At approximately 1–2 feet, fully raise the collective to slow the rate of descent and cushion the landing. As the skids touch down, apply slight forward cyclic. Once firmly on the ground, slowly lower the collective full down. Use caution to avoid any sideward or rearward movement on touchdown to prevent the possibility of a rollover.

If simulating a tail rotor failure at a hover, allow the helicopter to yaw a maximum of 90° to the right, then perform the hovering autorotation.

NOTE

Other than for a T/R failure at a hover, it is recommended that the instructor rolls the throttle off, then the student maintains heading with right pedal once the engine failure is detected.

PERFORMANCE STANDARDS:

	Private	Commercial
Heading	± 10°	± 5°
Touchdown	Level	Level

POWER FAILURE AT ALTITUDE—FORCED LANDING

PURPOSE:

To teach the student how to recognize an engine failure, properly enter an autorotation, select a landing area and maneuver to it.

DESCRIPTION:

During cruise flight with the student at the controls; the instructor will initiate the forced landing by rolling the throttle smoothly to the idle position splitting the needles. The student will immediately lower the collective full down co-coordinated with the right pedal for trim, and aft cyclic to maintain attitude. This should be accomplished quickly enough to prevent the rotor RPM from decaying below 88%. As the rotor RPM builds back into the green, increase collective as necessary to maintain rotor RPM between 95%–100%. Once established in an autorotative descent, select an intended landing area. Maneuver the helicopter as necessary to align the aircraft with the intended landing area, generally headed into the wind. Use increases in the collective and/or forward cyclic to prevent the rotor from over speeding while maneuvering. Airspeed should be adjusted to 60–70 KTS.

Prior to passing through 300 feet, the aircraft should be aligned with the touchdown area, at 60–70 KTS, rotor RPM between 95%–100%, and in trim. Execute a power recovery and transition to normal climb.

NOTE

Insure an N1 deceleration check has been performed and the cabin heat is off prior to conducting this maneuver.

The instructor should apply the recommendations contained in Safety Notice #27.

PERFORMANCE STANDARDS:

	Private	Commercial
RPM on Entry	Above 88%	Above 88%
Airspeed	+10 KTS – 5 KTS	+5 KTS
Area Selection	Suitable	Suitable

RAPID DECELERATION (QUICK STOP)

PURPOSE:

To simulate a condition when a rapid decrease in forward airspeed is required as in an aborted takeoff.

DESCRIPTION:

Perform a normal takeoff into the wind. Once a minimum altitude of 25 feet is attained, apply additional forward cyclic to accelerate to 40–50 KTS while maintaining altitude. Begin the quick stop by smoothly lowering the collective, adding right pedal, and simultaneously applying aft cyclic to decelerate. Apply aft cyclic as needed to maintain entry altitude throughout the deceleration. As airspeed is lost, the helicopter will begin to settle. Slowly raise the collective to control the rate of descent adding forward cyclic to level the helicopter. Maintain heading with pedals. Terminate at a stabilized 5-foot hover. Use caution to avoid terminating at a high hover or in an extreme tail low attitude.

PERFORMANCE STANDARDS:

	Private	Commercial
Heading	± 10°	± 5°
Altitude	± 15 feet	± 10 feet
Termination Point	± 50 feet	± 25 feet

SHALLOW APPROACH AND RUNNING LANDING

PURPOSE:

To simulate an approach and landing when sufficient power for hovering is not available.

DESCRIPTION:

On final approach, the helicopter should be headed into the wind at 60 KTS and 300 feet AGL. When a shallow approach angle of 5° is intercepted, begin the approach by lowering the collective to maintain the approach angle. Maintain entry airspeed until apparent rate of closure and groundspeed appear to be increasing. Begin a slow deceleration with aft cyclic, maintaining approach angle by reducing collective and keeping the aircraft in trim. Plan to arrive at the point of intended touchdown at or slightly above effective translational lift. Prior to ground contact, insure that the helicopter is in a level attitude. After ground contact, maintain heading with pedals and slowly lower the collective for braking action until the helicopter comes to a complete stop.

Crosswind Considerations:

As in normal and steep approach, crab the helicopter above 50 feet AGL, and use a slip below 50 feet AGL to align the aircraft with the ground track.

PERFORMANCE STANDARDS:

	Private	Commercial
Heading	± 10°	± 5°
Touchdown Point	± 50 feet	± 25 feet
Touchdown Speed	Above ETL	
Torque	Less than hover power	

SLOPE OPERATIONS

PURPOSE:

To land from a hover and takeoff to a hover from a sloping surface.

DESCRIPTION:

Prior to conducting slope operations, the pilot must be thoroughly familiar with dynamic rollover characteristics. For training, use a maximum slope angle of 5°.

Slope Landings:

Position the helicopter cross slope at a stabilized 5-foot hover headed into the wind. Lower the collective slightly to establish a slow rate of sink. When upslope skid contacts the ground, begin applying lateral cyclic in the direction of the slope (upslope) to hold the skid against the slope. Maintain heading with pedals. Continue to apply cyclic into slope as the collective is lowered until the down slope skid is firmly on the ground. Once the collective is full down, center the cyclic to allow safe "head clearance" on the upslope side.

Slope Takeoffs:

The procedure for a slope takeoff is almost the exact reverse of that for a slope landing. Apply cyclic into the slope (upslope) and slowly begin to raise the collective. As the helicopter becomes light on the skids, pause and neutralize any aircraft movement. Continue to raise the collective maintaining heading with pedals. When the down slope skid breaks ground, slowly begin to center the cyclic. As a level attitude is reached, the cyclic should be approximately neutral. Continue to raise collective, maintaining position over the ground with cyclic and heading with pedals until a stabilized 5-foot hover is attained.

PERFORMANCE STANDARDS:

	Private	Commercial
Heading	± 10°	± 5°

VORTEX RING STATE

PURPOSE:

To demonstrate the dangerous results of operating at low airspeeds, moderate to high power settings, and high rates of sink (Vortex Ring State).

DESCRIPTION:

The vortex ring state is most dangerous when it happens at relatively low altitudes. The most common condition is during a steep approach with a tailwind. It should be demonstrated at an altitude of at least 1000 feet AGL.

To enter a maneuver, adjust the power to approximately 30% torque. Hold altitude with aft cyclic until the airspeed approaches 20 KTS. Allow the sink rate to increase to 300 FPM or more as the attitude is adjusted to obtain airspeed of less than 10 KTS. The aircraft will begin to shudder. Application of additional up collective will increase the vibration and sink rate while the cyclic and pedal effectiveness is reduced. Once the condition is well developed, rate of sink in excess of 2000 FPM can result. Recovery should be initiated at the first sign. The maneuver can also be entered from an OGE hover.

There are two recovery techniques:

1. The traditional technique is to apply forward cyclic to increase airspeed and simultaneously reduce the collective. When the airspeed indicates 20–30 KTS and the trim strings have become effective raise the collective to takeoff power and adjust the cyclic to a maximum performance climb attitude. The recovery is completed when the VSI reads 0.

2. A more efficient recovery technique is called the Vuichard Recovery. Initiate the recovery by raising the collective to takeoff power (70% torque for training), simultaneously applying left pedal to maintain heading and right cyclic (10°–20° bank) to get lateral movement. Once the right side of the rotor disc reaches the upwind part of the vortex the recovery is completed. Average loss of altitude during the recovery is 20–50 feet.

PERFORMANCE STANDARDS:

The pilot must thoroughly understand and recognize the vortex ring state and be able to safely recover using either of the above recovery techniques.

ENHANCED AUTOROTATION PROCEDURES

PURPOSE:

To understand the different elements that can be used to maneuver the helicopter in autorotation. This training is only recommended for students who hold at least a private pilot certificate.

DESCRIPTION:

Each element will be discussed. Once the student has an understanding of the elements one or more can be combined in one autorotative glide.

Use of turns

Left, right, or "S" turns can be used to decrease the glide distance in autorotation. It is important to maintain proper attitude and trim when turning to prevent increased descent rates. Adjust the collective as necessary in the turn to maintain rotor RPM between 95%–100%. A large turn (270°–360°) is not recommended since for much of the turn the pilot will lose sight of the landing area and will be unable to determine the effect of wind on the glide.

Use of airspeed

Airspeeds from zero to max glide airspeed (90 kts in an R66) can be used to adjust the autorotative glide distance as necessary. Maximum glide distance configuration is covered later in this maneuver so this discussion concerns reducing airspeed. It is recommended an entry altitude of 1500–2000 feet AGL be used so the student can get an extended time flying at the lower speeds in autorotation. Enter the autorotation so that a normal glide will take the helicopter well past the point of intended landing thus requiring a shortened glide distance. Once the glide is established apply aft cyclic to a 10°–15° nose high attitude. Adjust the collective as necessary to control increases in rotor RPM. At approximately 25–30 kts the nose of the aircraft will come down to a level attitude due to the upward flow of air acting on the tail cone and horizontal stabilizer. Maintain this configuration and observe the landing area moving up on the windshield. When a normal autorotative angle is achieved or approaching 500 feet AGL, lower the nose to 10°–15° nose down to increase airspeed back to the normal autorotative speed of 60–70 kts.

Use of pedals

Set the maneuver up at 1500–2000 feet AGL with the point of intended landing and the wind 90° from the helicopter's ground track (out the left or right door). Since the left pedal is the strong pedal in autorotation, it is recommended the landing area be positioned out the left door requiring left pedal to turn. However, the student should experience use of both pedals. Enter the autorotation and slow the airspeed as in the "use of airspeed" maneuver. Once the nose comes down to the level attitude, apply pedal to align the aircraft with the desired track towards the landing area. Use of left pedal will decrease the rotor RPM requiring the pilot to lower the collective as necessary to maintain the rotor RPM. (cont'd)

ENHANCED AUTOROTATION PROCEDURES (cont'd)

Use of pedals (cont'd)

The remainder of the maneuver is the same as the “Use of airspeed” discussion.

Use of sideward flight

The purpose of using sideward flight in an autorotative glide is when the point of intended landing is almost directly below the helicopter. Set up the condition with the wind 90° (left or right) from the aircraft’s ground track at 1500–2000 feet AGL. Enter the autorotation directly over or just prior to the intended landing area. Decrease the airspeed as in the “Use of airspeed” maneuver. When the nose comes down to the level attitude apply lateral cyclic in the direction of the desired sideward flight and opposite pedal to prevent the aircraft from weather vaneing towards the direction of flight. The resulting slip and wind direction will move the helicopter downwind from the landing area. Once the helicopter is far enough away from the landing area stop the sideward flight with opposite cyclic. Opposite pedal is then applied (as in the “use of pedal” maneuver) to align the aircraft into the wind tracking towards the landing area and lower the nose to regain airspeed. Again, left pedal is the strong pedal in autorotation, so sideward flight to the right, requiring the use of left pedal is the easier of the two sideward flight directions.

CAUTION

When using the above techniques to maneuver in autorotation the nose must be lowered to regain airspeed no lower than 500 ft AGL. Below 500 ft AGL use only turns to maneuver.

Maximum Glide Distance Configuration

In FAR Part 27 approved helicopters the maximum glide distance configuration is found in the Pilot’s Operating Handbook (POH). It is 90 kts/90% rotor RPM in the R66. The purpose in practicing this maneuver is not only to glide the furthest distance in autorotation, but also, to get the pilot accustomed to the low RPM warning system being on for extended periods and developing the pilot’s ability to determine if a glide will be “to long” or “to short”. Enter the autorotation at 1500–2000 feet AGL to give the student an extended time to fly at the max glide configuration. Adjust the airspeed to 90 kts and increase the collective to set the rotor RPM at 90% (the low RPM horn/light will be on the entire time the RPM is below 95%). It’s very important to keep the aircraft in trim during the entire glide. While at the max glide configuration reference any movement of the point of intended landing up or down on the windshield. If the landing area moves up the glide will not reach the area and a new area should be selected. If the landing area begins to move down then the glide will take the aircraft past the area so exit the max glide configuration. Allow the rotor RPM to build back into the normal range below 500 ft AGL.

ENHANCED AUTOROTATION PROCEDURES (cont'd)

Minimum Rate of Descent Configuration

The minimum rate of descent configuration is also found in the POH. It is 60 kts/90% rotor RPM in the R66. The purpose of practicing this maneuver is not only to autorotate at the slowest descent rate, but also, to practice preforming another procedure such as an air restart, mayday call or a reconnaissance of the landing area while still flying the helicopter in autorotation. Enter the autorotation at 1500–2000 feet AGL. After establishing an autorotative glide simultaneously apply aft cyclic to slow the helicopter to 60 kts and raise the collective to reduce the rotor RPM down to 90% (the low RPM horn/light will be on the entire time the RPM is below 95%). Realize that these two control inputs compete with each other, in that the aft cyclic tends to increase the RPM while the pilot is trying to reduce the RPM with the collective. First, build proficiency establishing and maintaining the minimum rate of descent configuration then add the performance of a task such as, a simulated air restart, mayday call, or reconnaissance into the autorotation. Return to the normal airspeed and rotor RPM prior to descending below 500 feet AGL.

PERFORMANCE STANDARDS:

The student will have an understanding of the techniques that can be used to maneuver the helicopter in autorotation and be able to use these techniques to maneuver within 100 feet of a predetermined spot.

HYDRAULIC OFF APPROACH AND LANDING

PURPOSE:

To simulate an approach and landing with a hydraulic system failure.

DESCRIPTION:

NOTE
It is recommended this maneuver only be performed with an instructor at one set of controls.

During cruise flight or on downwind in the traffic pattern, the instructor will identify the hydraulic control switch, instruct the student to relax on the controls, then turn the hydraulic control switch off. Once the increase in control forces is noticed, the pilot should simulate executing the hydraulic failure procedure by noting the switch position, simulate turning the switch off and adjusting airspeed for comfortable control. It is suggested the pilot then vigorously exercise the cyclic and collective to develop a feel for the control forces that will be needed. Note a much greater force is needed to raise the collective than to lower it and fore & aft cyclic is much more difficult than lateral cyclic. The R66 Pilot's Operating Handbook (POH) recommends a running landing in the event of a hydraulic control failure. Execute a shallow approach and running landing (page 22). Once the aircraft has come to a complete stop on the ground the instructor should, again, identify the hydraulic control switch, instruct the student to relax on the controls, then turn the hydraulic control switch on.

CAUTION
Below 100 ft AGL on the approach, the hydraulic control switch should not be turned on until the aircraft is at a full stop on the ground. If control of the helicopter becomes questionable, initiate a go-around and do not turn the hydraulics back on until the aircraft is above 100 ft AGL and the airspeed is above 40 knots.

PERFORMANCE STANDARDS:

Touchdown should be above ETL in a level attitude with the skids parallel to the ground track.

HOVER OUT-OF-GROUND EFFECT (OGE)

PURPOSE:

To hover the helicopter out-of-ground effect (OGE), perform 90° hovering turns and properly descend to an in-ground-effect hover (IGE) over a predetermined spot. Recommended minimum OGE hover altitude for training is 50 feet.

DESCRIPTION:

NOTE
It is recommended this maneuver only be performed with an instructor at one set of controls.

The OGE hover can be initiated from the ground or at the termination of an approach. In both cases, proper performance planning needs to be accomplished to insure OGE capability by using the OGE Hover Ceiling vs Gross Weight chart in the Pilot's Operating Handbook and the IGE hover check referenced below.

From the Ground:

Headed into the wind, select at least two outside visual reference points (trees, poles etc.) that will aid in controlling aircraft drift during the maneuver; one point at the 12 o'clock position and one approximately 90° in the direction of the intended turn. These points should be a minimum distance from the helicopter of at least twice the intended hover altitude. Any additional reference points that are available can be used to fine tune position over the ground. Perform a takeoff to a 2 foot IGE hover and complete a hover check to confirm available power. The maneuver should not be attempted unless the IGE hover power is 15% torque or 50°C MGT below the 5 minute limit.

Begin the ascent to an OGE hover by increasing the collective, maintain heading with the pedals and crosscheck both reference points. The lateral reference is especially important to control the common tendency of forward drift during the ascent and descent. Once established at an OGE hover, check power and effects of any difference in wind speed or direction. Use the outside reference points to control drift over the ground and altitude.

It is recommended to begin with a left pedal turn to evaluate the amount of tail rotor thrust available. Since it takes more thrust to stop a right pedal turn, do not attempt a right pedal turn if thrust during the left turn appears marginal. Prior to beginning the turn, clear the area in both directions and anticipate the effect of the wind during the turn. Begin the turn with the appropriate pedal and maintain a slow, steady turning rate. Avoid high turn rates especially with right pedal turns. Stop the turn at the 90° point, stabilize the hover using the reference points then slowly begin a turn in the opposite direction terminating at the original position (heading).

Begin the descent by lowering the collective, maintaining position over the ground with the cyclic. Again, avoid the tendency to drift forward during the descent. Using outside references, maintain a slow, steady descent rate. (cont'd)

HOVER OUT-OF-GROUND EFFECT (OGE) (cont'd)

Terminate the descent at an IGE hover over a predetermined spot or continue to the ground.

From an approach:

On final insure the aircraft is headed into the wind then establish a 5° shallow approach angle to a predetermined spot on the ground. During the last 200 feet begin to slow the closure rate to lose ETL while avoiding a descent rate greater than 300 ft/min. Prior to establishing an OGE hover over the predetermined spot, select the forward and lateral reference points. It is recommended that initially the student be familiar with the predetermined spot on the ground and the reference points and then move to unfamiliar areas.

Once established in an OGE hover over the predetermined spot, proceed as explained in "From the Ground".

Once proficiency in the above conditions is achieved, demonstration/student practice at altitudes above 500 feet AGL will reinforce the importance of proper reference and aircraft control.

RISK MANAGEMENT:

- Understand the risk of operating in the shaded area of the height/velocity diagram.
- Avoid excessive descent rates to prevent entry into the vortex ring state.
- Focus on the need for left pedal to anticipate the loss of tail rotor effectiveness (LTE)
- Monitor engine temperature, pressure and power limits to avoid an exceedance.
- Avoid unnecessary distractions during the maneuver.

PERFORMANCE STANDARDS:

	Private	Commercial
Position over ground	No FAA Private Pilot standards established. RHC recommends training to Commercial standards.	± 10 ft
OGE hover altitude		± 5 feet
Heading		± 5°
Descent Rate		Safe

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