STANDARDIZATION

OF

HELICOPTER MANEUVERS

TH-13T

CONTACT AND BASIC INSTRUMENTS

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PART I - CONTACT

1. Pre-solo maneuvers.

a. Takeoff to hover.

(1) Required -

(a) 3200 rpm.

(b) Constant heading.

(2) Analysis of maneuver. Increase rpm to 3200 with collective in full low pitch. Place cyclic control in neutral position and add slight amount of left pedal. Raise collective pitch control with a constant slow timed pressure until hovering altitude of three feet is reached. As the helicopter breaks ground, make whatever minor corrections are necessary with cyclic control to assure absolute vertical ascent, and apply pedal as necessary to maintain directional control. During ascent, adjust throttle to maintain 3200 rpm.

b. Hovering turns.

(1) Required -

(a) 3200 rpm.

(b) Altitude three feet.

(c) Remain over spot.

(d) Constant rate of turn.

(2) Analysis of maneuver. Apply pressure on desired pedal to initiate turn. Use pressure and counter pressure on pedals, to maintain constant rate of turn. Coordinate cyclic control to maintain position over spot. Coordinate collective pitch and throttle to maintain altitude and 3200 rpm.

c. Sideward flight.

(1) Required -

(a) 3200 rpm.

(b) Altitude three feet.

(c) Constant rate of movement.

(d) Slow rate of movement.

(e) Path perpendicular to heading.

(f) 90° clearing turn in direction of sideward flight.

(2) Analysis of maneuver. The direction of flight is maintained by cyclic control. The heading is kept perpendicular to ground track with pedals. Coordinate collective pitch and throttle to maintain altitude and 3200 rpm.

d. Rearward flight.

(1) Required -

(a) 3200 rpm.

(b) Altitude three feet.

(c) Constant rate of movement.

(d) Slow rate of movement.

(e) Path 180° to heading.

(f) 90° clearing turn.

(2) Analysis of maneuver. Maintain direction of flight with cyclic control. Keep heading perpendicular to ground track with pedals. Maintain altitude with collective pitch.

e. Landing from hover.

(1) Required -

(a) 3200 rpm.

(b) Constant heading.

(c) Vertical descent.

(2) Analysis of maneuver. Decrease collective pitch to effect a constant, smooth rate of descent until touchdown. Make necessary corrections, with pedals to maintain heading. Make necessary corrections, with cyclic, to maintain level attitude and prevent movement over the ground. (Upon initial contact with the ground, continue to decrease collective pitch smoothly and make necessary cyclic and pedal corrections until the gear is firmly on the ground and the collective pitch is in FULL DOWN position).

f. Normal takeoff.

(1) Required -

(a) 3200 rpm throughout maneuver.

(b) Straight ground track.

(c) When climb is established.

1. 50 knots.

2. Take off manifold pressure. (33 inches maximum).

(2) Analysis of maneuver.

(a) Hover briefly to assure that engine and controls are operating properly; note position of cyclic control, which will vary with amount and distribution of load. Prior to takeoff, a 90° clearing turn will be completed.

(b) Select two points straight ahead on an extension of the center line of the runway to be used for drift correction during climbout.

While at a three foot hover, apply slight forward pressure on the cyclic to initiate forward hovering flight. As the aircraft accelerates, use collective pitch as required to maintain three feet of altitude until sufficient translational lift is attained to begin the ascent. At this point, additional forward cyclic is required to prevent a reduction in airspeed due to the tendency of the nose of the aircraft to rise with increased lift. After gaining effective translational lift, coordinate power, cyclic control, and pedals smoothly to establish 27 inches of manifold pressure, 3200 engine rpm, and a continuous increase in airspeed to 50 kts.

(c) After the climbout has been established, altitude and airspeed must be gained simultaneously to avoid being in a critical position in the event of engine failure. As airspeed is increased, the streamlining effect of the fuselage reduces engine torque effect, requiring the gradual reduction of left pedal.

(d) When the airspeed has been stabilized at 50 kts with 27 inches of manifold pressure, the aircraft is in a normal climb.

(e) On the takeoff leg below 50 ft, wind drift correction will be made by slipping the helicopter into the wind above 50 ft, wind drift correction will be made by crabbing the helicopter into the wind.

NOTE: To compute takeoff power after pickup, establish an in ground effect hovering altitude of three feet. Check manifold pressure gauge and note No. 2 compressor pressure indicator reading, then check No. 1 manifold pressure which is the power required to hover reading. Determine the actual difference between the two readings and subtract the normal difference of "2 hg. The pressure reading between the No. 1 and No. 2 indicators after subtracting the normal difference is the EXCESS POWER AVAILABLE in inches of mercury MAP (Manifold Atmospheric Pressure). EXCESS POWER AVAILABLE should never exceed 34" hg. on the No. 1 indicator.

g. Normal approach.

(1) Required -

(a) 12° approach angle.

(b) Entry altitude 300 ft above terrain or traffic pattern altitude.

(c) Entry airspeed 50 knots.

(d) 3200 rpm.

(2) Analysis of maneuver.

(a) The approach is initiated by lowering the collective pitch control the amount required to descend at an angle of 12°. During the approach, corrections for deviations from the desired line of descent should be made by proper application of collective pitch.

(b) The initial airspeed should be maintained until the point on the approach has been reached; through evaluation of apparent ground speed, it has been determined that forward speed must be progressively decreased in order to arrive at hovering position at the intended landing spot. As forward speed is gradually reduced, additional power must be applied to compensate for the decrease in translational lift and to maintain the proper angle of descent.

(c) Throttle, antitorque control, and cyclic control must be coordinated with collective pitch changes to maintain proper rpm settings and a straight ground track.

(d) The approach should be terminated at three feet at the intended landing spot with zero groundspeed.

h. Straight and level flight.

(1) Required -

(a) 3200 rpm.

(b) 60 knots.

(c) Maintain ground track.

(2) Analysis of maneuver.

(a) Attitude and airspeed are controlled by cyclic control in straight and level flight. The altitude is controlled by collective pitch and throttle. If collective pitch is increased (constant rpm 3200) and attitude of the helicopter remains constant, an increase in altitude will result with no gain or loss of airspeed. If the collective pitch is decreased, and attitude and rpm of the helicopter remain constant, a decrease of altitude is controlled by power, collective pitch and throttle, <u>not</u> cyclic control.

(b) In crosswind, crab helicopter the amount required to maintain the desired ground track.

i. Normal climb.

(1) Required -

(a) 3200 rpm.

(b) 50 knots.

(c) Manifold pressure to establish a desired rate of climb under different load and density altitude conditions. The desired rate of a climb is 500 fpm.

(2) Analysis of maneuver.

(a) Settings for normal climb are - desired manifold pressure, 3200 rpm, and 50 kts airspeed. (Manifold pressure <u>must</u> be reduced to 27" within 2 minutes after application of maximum takeoff power setting.)

(b) Power, cyclic control, and pedals are coordinated smoothly to maintain a constant heading with desired manifold pressure and a pitch attitude that will maintain an airspeed of 50 knots.

(c) On takeoff the helicopter is in a normal climb when airspeed is stabilized at 50 kts (between 70 and 100 ft altitude.)

(d) As the desired altitude is being approached, lead forward cyclic to accelerate to 60 kts. When desired altitude is reached, control altitude with collective pitch.

j. Normal descent.

(1) Required -

(a) 3200 rpm.

(b) 50 kts.

(c) Manifold pressure necessary to maintain line of descent.

(2) Analysis of maneuver.

(a) Settings for normal glide are - required manifold pressure, 3200 rpm, and 50 kts airspeed.

(b) Power, cyclic control, and pedals are coordinated smoothly to maintain a constant heading, establish required manifold pressure, and establish a pitch attitude that will result in a gradual change of airspeed to 50 knots.

k. Hovering autorotation. (Hydraulic boost failure, see para. o.)

(1) The hovering autorotation is a practice maneuver designed to develop the reaction time and skill required to recover from an engine failure while hovering or during the initial takeoff.

(2) Required -

(a) Altitude - 3 ft hovering altitude.

(b) 3200 rpm.

(c) Head helicopter into wind.

(3) Analysis of maneuver.

(a) From a hovering position, helicopter is headed into the wind. Close throttle to override position, simultaneously apply right pedal as required to maintain heading; apply cyclic control as required to maintain position over spot. (While closing the throttle, use caution not to raise or lower the collective pitch). The inertia of rotor blades will produce enough lift, after autorotation has been entered, to cause the helicopter to remain motionless, momentarily, before it begins to settle.

(b) At one foot above the ground, apply sufficient collective pitch to cushion the landing. After ground contact, with the helicopter resting firmly on the ground, smoothly lower collective pitch to the FULL DOWN position.

l. Basic autorotation. (Hydraulic boost failure, see para o.)

(1) The basic autorotation is recommended for general use because it provides a low rate of descent which in turn gives the pilot better judgment in applying collective pitch for touchdown. It is used when the selected landing area is sufficiently long and smooth to permit a brief ground run.

(2) Required -

(a) Heading into wind or traffic direction.

(b) Entry altitude (50 ft above terrain or traffic altitude at stagefield).

(c) 60 kts entry speed.

(d) Rotor rpm within the green arc.

(3) Analysis of maneuver.

(a) From an entry altitude of 500 ft, airspeed 60 kts, reduce collective pitch to FULL DOWN position, using sufficient right pedal to trim aircraft, maintain 3200 rpm. Reduce throttle to split needles and adjust trim with right pedal. Establish engine rpm at 2300. Establish a 50 kt altitude. Check rotor rpm and call out setting (rotor in the green or rotor in the yellow).

(b) When at 100 ft and assured that the landing can be made in the intended landing area, student will check rotor rpm for positive assurance that it is in the green arc. If so, he will call out rpm in green - override and close the throttle. (This is a statement and not a question.) Level the helicopter. The collective pitch must be held firmly in the FULL DOWN position.

(c) At 15 ft, smoothly apply sufficient collective pitch to slow rate of descent. Maintain a level attitude with cyclic and directional heading with pedals. As the helicopter nears the ground, smoothly apply additional collective pitchas required to cushion the landing. Cyclic and pedal control must be applied so as to touch down in a straight and level attitude.

(d) After ground contact is made, collective pitch is normally held stationary; however, if braking action is desired, collective pitch may be lowered as required. (Cyclic is held slight forward of neutral position.) Maintain heading and direction with pedals.

NOTE: In strong crosswind, a power recovery should be made if there is insufficient pedal to maintain alignment. In event of insufficient pedal, for directional control after touchdown, cyclic control is used with the turn.

m. Forced landing procedure. (Hydraulic boost failure, see para o.)

(1) A practice forced landing is a simulated emergency situation designed to develop the student's proficiency, reaction, and judgment for any possible future emergency.

(2) Analysis of maneuver.

(a) A practice forced landing will be initiated by the instructor pilot by slowly reducing engine rpm to 2300 and stating "forced landing".

(b) The student will immediately lower the collective pitch to the full down position, simultaneously, applying sufficient right pedal to trim the aircraft.

(c) If flying in a direction other than into the wind, an autorotative turn will be made into the wind and/or toward the intended landing area. The approach to the selected area must be planned and executed in such a manner that final approach will generally be into the wind.

(d) Check and call out - rotor in the green. The airspeed will be adjusted between 55 - 40 kts, as required, to extend or shorten the glide to reach a suitable touchdown area.

(e) At an altitude of 100 ft and/or when it is determined that the selected area may be reached, power off, and close the throttle to the override position. At an altitude of 35 to 50 ft, place the helicopter in a slight decelerating attitude so that the ground speed on touchdown will be compatible with terrain, at 10 to 15 ft, smoothly apply sufficient collective pitch to slow the rate of descent.

NOTE: Prior to going into override, student will recheck rotor rpm for positive assurance that it is in the green arc. If so, he will call out - rotor rpm in the green - override and close the throttle. (This is a statement and not a question.)

(f) As the aircraft nears the ground, smoothly apply additional collective pitch to cushion the landing; maintain straight directional heading with pedal and an attitude level with terrain with cyclic.

(g) After ground contact is made, hold cyclic slightly forward of neutral. Collective pitch will normally be held stationary until helicopter is stopped; however, if braking action is desired, lower pitch smoothly as required.

(3) Responsibility for making recovery from forced landing.

(a) Upon being given a simulated forced landing, the student must assume that he has experienced a loss of power and act accordingly. His responsibility is to get the aircraft safely to the ground by establishing a planned autorotative descent to a suitable area and accomplishing a smooth touchdown with minimum forward speed.

(b) The decision for making a touchdown rests with the instructor pilot but will consider each forced landing as continuing to the ground unless directed otherwise. The only exception to this would be, in the event of a very unlikely situation, where a misunderstanding may exist between the instructor pilot and the student or where, for any other unforeseen circumstance, the recovery order is not given even though a touchdown would obviously result in disaster. In such an instance, the student will announce and execute a power recovery. (See para o.)

n. Autorotations with Simulated Hydraulic Boost Failure.

(1) Due to the fact that in the event of engine failure, there will also be a hydraulic boost failure, hovering and basic no flare autorotations with simulated hydraulic boost failure are practiced.

(a) To simulate hydraulic boost failure during the basic no flare autorotation the hydraulic control switch should be placed in the off position while on downwind.

(b) To simulate hydraulic boost failure during the hovering autorotations the hydraulic control switch should be placed in the off position while at a hover.

(c) To simulate boost failure during the practice forced landing the hydraulic control switch should be placed in the off position while in cruise prior to the initiation of the forced landing.

(2) Whey hydraulic boost failure is detected reduce all control motions to the minimum required to complete the maneuver.

(3) Increased control pressures may be required to safely accomplish the autorotations.

o. Power recovery.

(1) A power recovery is used to terminate the autorotation or simulated forced landing at a point prior to actual touchdown or to recover from a bad landing. Two different procedures used for recovering with power during simulated forced landings or dual practice autorotations are as follows:

(a) Power recovery.

1. Used under situations when the instructor elects to discontinue an autorotative descent.

2. Recovery is immediate following spoken command of instructor pilot as "power recovery".

3. May be ordered at any time after entering autorotation.

4. Given the command "power recovery", the student will join the needles at 3200 rpm maintaining proper trim of aircraft with use of pedals. When the needles have joined, sufficient collective pitch and power are applied to establish a normal climb with 3200 rpm, 50 knots, and climb manifold pressure.

(b) Terminate with power.

1. Used under situations when the instructor pilot elects not to make a touchdown autorotation, but desires that the student continue an autorotative approach to the desired touchdown area before recovering.

2. Recovery is made after performing a planned autorotative approach: The instructor directs "terminate with power."

3. Upon given the command "terminate with power" the student will continue the autorotative descent. At 100 ft, student will join needles at 3200 rpm, maintaining proper trim of aircraft with use of pedals. After needles have joined, sufficient collective pitch and power are applied at an altitude that will decrease the rate of descent to zero at an altitude of three ft with aircraft in level attitude, and 3200 rpm maintained throughout. (Speed, at this point, should be the same as if an actual touchdown were to be effected.) Trim of aircraft, with use of pedals, will be maintained throughout. An altitude of three feet will be maintained until aircraft is brought to a stationary hover or until a normal climb is established.

(c) Power recovery from override position.

1. Demonstrate maneuver to teach student the proper technique used for recovery from a bad autorotative landing; is initiated after application of collective pitch during a basic no-flare autorotation.

2. Analysis of maneuver.

a. Initiate a basic no-flare autorotation and continue descent, as if for touchdown, with throttle closed to override position.

b. At 10 to 15 ft, smoothly apply collective pitch to stop descent at three feet. Maintain level attitude and forward speed.

c. Allow rotor rpm to decrease to 325 rpm, then firmly add throttle and collective pitch to obtain 3200 rpm engine speed.

d. Be alert to apply corrective pedals as power is applied to maintain directional heading.

p. Traffic pattern.

(1) Required -

(a) Initial climb 50 knots.

(b) Altitude 500 ft above terrain or traffic altitude.

(c) Airspeed 60 knots.

(d) 3200 rpm.

(2) Analysis of maneuver. After takeoff, climb straight ahead at 50 knots to 400 ft, turn on the crosswind leg, and continue to climb at 50 kts. The turn to the downwind leg may be made after 500 ft, or traffic altitude and 60 kts has been obtained or started so that traffic altitude and 60 kts is reached as the turn is completed. The flexibility will enable placing the downwind leg in proper traffic perspective when crosswind conditions exist. Turn on base leg, with due consideration to preceding helicopters in the traffic pattern and spot of intended landing. Decrease power to distribute loss of altitude and airspeed equally throughout the entire base leg. A turn, planned to align the helicopter with the selected lane, will be made to the approach leg at 500 ft and 50 kts.

(3) Wind drift corrections.

(a) On the takeoff leg, below 50 ft, wind drift correction will be made by slipping the helicopter into the wind; above 50 ft, wind drift correction will be made by crabbing the helicopter into the wind.

(b) On the approach leg, above 100 ft, wind drift correction may be made by crabbing or using a combination crab and slip, if wind is from pilot's side. Below 100 ft, wind drift correction will be made by slipping the helicopter into the wind. On the crosswind, downwind, and base legs, wind drift correction will be made by crabbing the helicopter into the wind.

2. Intermediate maneuvers.

a. Maximum performance takeoff. In order to facilitate training for the instrument TAKEOFF during the Basic Instrument Phase, the maximum performance

TAKEOFF will be executed as described for instrument TAKEOFF with the exception that the maneuver is executed visually, without the hood. (See ITO Chapter 2, Basic Instruments for explanation of maneuver.)

b. Antitorque failure while hovering.

(1) This maneuver is designed to develop the reaction time and skill required to recover from an antitorque failure while hovering.

(2) Required -

(a) Altitude three feet.

(b) 3200 rpm.

(c) Helicopter 90° to the wind (wind from right side).

(3) Analysis of maneuver. From a hovering position, start a positive turn to the right. After a turn of 90°, close throttle to override position. This action will stop the turn. Hold the original pedal position stationary, in order to simulate the actual condition as closely as safety permits and apply collective pitch, as required, to slow descent and cushion landing. After touchdown, with the helicopter resting firmly on the ground, smoothly lower collective pitch to the FULL DOWN position.

c. Precision no-flare autorotation.

(1) Required -

(a) Heading into wind or traffic direction.

(b) Entry altitude (500 ft above terrain or traffic altitude at stagefield).

(c) Entry speed, 60 kts.

(d) Rotor rpm within green arc.

(2) Analysis of maneuver.

(a) From entry altitude of 500 ft, airspeed 60 kts, and lower collective pitch to the FULL DOWN position using sufficient right pedal to trim aircraft, maintain 3200 rpm. Reduce throttle to split needle and adjust trim with right pedal. Establish engine rpm at 2300. Select a spot two helicopter lengths short of intended landing spot; descend on a predetermined line which will result in an airspeed indication between 40 and 55 kts. Control line with cyclic control. Check rotor rpm (must be in green arc.) Call out setting.

(b) When at 100 ft and/or when assured that landing can be made in the intended landing area, close the throttle to the override position. (Prior to going into override, student will recheck rotor rpm for positive assurance that it is in the green arc.) If so, he will call out, rotor rpm in green - override and close throttle. (This is a statement and not a question.) Assume a moderate decelerating attitude. The collective pitch must be held firmly in the FULL DOWN position.

(c) At 15 ft, smoothly apply sufficient collective pitch to slow rate of descent. After initial pitch application, assume a level attitude with cyclic and directional heading with pedals. As the helicopter nears the ground, smoothly apply additional collective pitch, as required, to cushion landing.

(d) After ground contact, hold collective pitch stationary. However, if braking action is desired, lower collective pitch as required. Place cyclic control slightly forward of neutral. Maintain heading and path with pedals and cyclic control.

NOTE: This maneuver should be entered, closer in or further out than described above, so as to require an increased or decreased glide ratio momentarily, in order to intercept the predetermined line of descent. For practice the predetermined line of descent should be intercepted at a minimum altitude of 200 ft.

d. 180° autorotations.

(1) Required -

(a) Heading downwind.

(b) Entry altitude (500 ft above terrain or traffic altitude at stagefield).

(c) Entry speed, 60 kts.

(d) Rotor rpm within the green arc.

(2) Analysis of maneuver.

(a) From an entry altitude of 500 ft, airspeed of 60 kts, lower collective pitch to FULL DOWN position when opposite desired touchdown spot. Reduce throttle to split needles and adjust trim with right pedal. Establish engine rpm at 2300. Start turn with cyclic control. Angle of bank should be adjusted to insure roll-out on lane, airspeed should be maintained between 60-40 kts to adjust glide in order to arrive at desired touchdown spot.

NOTE: Turn must be completed by at least 50 ft above ground. No further attempt should be made to adjust airspeed or glide. The aircraft should be leveled in preparation for touchdown.

(b) When at approximately 100 ft and/or assured that landing can be made in the intended landing area, close throttle to the override position. (Prior to going into override, student will recheck rotor rpm for positive assurance that it is in the green arc.) If so, he will call out, rotor rpm in green override and close the throttle. (This is a statement and not a question.) The collective pitch must be held firmly in the FULL DOWN position.

(c) At 15 ft, smoothly apply sufficient collective pitch to slow rate of descent. Maintain a level attitude with cyclic and directional heading with pedals. As the helicopter nears the ground, smoothly apply additional collective pitch to cushion the landing.

(d) After ground contact, hold collective pitch stationary; however, if braking action is desired, lower collective pitch. Place cyclic control slightly forward of neutral. Maintain heading and path with pedals and cyclic control.

PART II - BASIC INSTRUMENTS

INSTRUMENT TAKEOFF

1. Definition. A takeoff completed solely with reference to all available instruments. A maneuver performed when there is no outside visual reference to control the attitude of the aircraft.

2. Maneuver procedure. After run-up and appropriate clearance is received, hover to the active runway or pad and use the following procedure in accomplishing an instrument takeoff:

a. Align aircraft with center of runway or pad and apply wind drift correction.

b. Rotate heading index to the heading shown (12 o'clock position).

c. Set the miniature aircraft of the attitude indicator one bar above the horizon bar. One bar width above is defined as the miniature aircraft setting on the top of the horizon bar.

d. Apply sufficient friction to collective pitch control and throttle to minimize over control.

e. Scan all engine instruments to determine operation in proper range.

f. Takeoff is started by making a predetermined power adjustment to takeoff power setting. (Hover power plus excess power available not to exceed 33 MAP): Power must be added smoothly and steadily.

g. Apply collective pitch until aircraft is light on skids. (Student's vision is outside aircraft at this time), compensating for additional power with pedals. As power is applied, maintain directional control (heading) initially with pedals until airspeed increases (generally 20 to 30 kts) then transition to corrdinated flight.

h. Maintain level flight attitude laterally (wings level) with cyclic.

i. As the aircraft becomes airborne, an application of forward cyclic is used to obtain initial acceleration, resulting in a sight picture on the attitude indicator of two bar widths below the horizon bar.

j. Cross-check the altimeter and vertical speed indicator to insure that altitude is being gained.

k. As the airspeed approaches the desired climbing airspeed of 50 knots, the nose is gradually raised to the appropriate climbing attitude.

l. As climbing airspeed and attitude is attained, the power should be adjusted to result in a rate of climb of 500 ft per minute (FPM). Power must be reduced to 27" MAP within two minutes after application of TAKEOFF power.

NOTE: MAP may not result in a rate of climb of 500 ft per minute.

m. Trim as required through all steps.

n. After level off, adjust attitude indicator for level flight.

STRAIGHT AND LEVEL FLIGHT

1. Effects of turbulence on straight and level flight usually causes constant changes in the helicopter's attitude, altitude, and heading. In every flight attitude, the forces acting on the helicopter have a definite relationship. These forces (lift, weight, drag, and thrust) must be in balance for straight and level, unaccelerated flight. When the instrument indicates a need for an adjustment to maintain a given performance, other instruments will reflect the amount and direction in which the adjustment should be made. For example, if the airspeed indicator shows a decrease in airspeed, the manifold pressure and/or altimeter will indicate the adjustment to be made in power and/or altitude. When altitude, airspeed, and level flight are being maintained, the miniature airplane of the attitude indicator should be adjusted to reflect the level flight attitude; thereafter, any deviation in attitude can be read directly from the attitude indicator. Corrections for attitude should be made when any deviation is observed.

2. Any deviation from the desired heading will be shown on the heading indicator. Immediate and smooth application of controls should be initiated to return the aircraft to the desired heading. The sooner a need for a correction is observed, the smaller the amount of correction needed. For deviations of 20°, a half-standard rate turn should be sufficient. Any time an instrument indicates a change in attitude, necessary adjustment should be made. Then, instead of watching that particular instrument to see the effects of the adjustment, the cross-check is continued before finally returning to the original instrument. In this way the entire panel will reflect the total effect of the adjustment. A helicopter does not remain long in any given attitude; therefore, by the time a cross-check has been completed and the necessary adjustments have been made, another cross-check must be initiated.

3. During straight and level flight, heading and airspeed are maintained with cyclic control; altitude with power, trim with pedals. Power is used to adjust minor variations of altitude only if the desired altitude cannot be maintained by varying pitch attitude without exceeding ± 10 knots airspeed.

CLIMBS AND DESCENTS

1. Definition. A climb or descent is a maneuver where the aircraft is intentionally climbed or descended at a specific rate.

2. Maneuver procedure. Establish the aircraft at the desired climbing (50 kts) or descending (60 kts) airspeed and proceed as follows:

a. Adjust to maintain the desired rate of climb or descent. (33" max MAP for two minutes, after two minutes 27" MAP must be used which may not produce desired rate of climb).

b. As power is adjusted, keep aircraft in trim with pedals.

c. If the initial power adjustment does not produce the desired rate of climb or descent, then adjustments of power and/or pitch should be made. (See note after a. above).

d. As a rule of thumb, one inch of manifold pressure will change the rate of climb or descent 100 fpm.

e. A five-knot change in airspeed, by varying pitch attitude, may be used for <u>minor</u> variations of rate of climb or descent. If a five-knot change of airspeed fails to give the desired results, then a power adjustment must be made.

f. Lead the level off and adjust the power to maintain the desired airspeed and level flight.

g. To level off, power is adjusted prior to reaching the desired altitude. The amount of lead depends upon the rate of climb or descent and/or individual technique. (A rule of thumb is 40 ft lead.)

ACCELERATION AND DECELERATION

1. Definition. Accelerations and decelerations is a maneuver designed to develop coordination of all controls.

2. Maneuver procedure. Establish the aircraft in straight and level flight; 60 kts accelerate to 70 kts decelerate to 40 kts and accelerate to 60 kts.

a. Adjust power to acceleration or deceleration setting. (As a rule one inch of manifold pressure will result in a 5 kt change in airspeed.) (When accelerating add 2" to predetermined power setting, i.e., to increase 20 kts airspeed, 1 inch = 5 kts, or 4 inches plus 2 inches.)

b. Adjust pitch attitude for acceleration or deceleration.

c. Lead power adjustment as desired airspeed is approached.

TIMED TURNS AND NEEDLE CALIBRATION

1. Definition. A timed turn is a turn in which the clock and turn indicator are the instruments used while turning the aircraft a definite number of degrees.

2. Maneuver procedure. In the event of heading indicator failure, turns can be made accurately by the time turn method; but only if the turn needle is properly calibrated. Calibration should be accomplished as soon as possible after takeoff.

a. Calibrating the needle.

(1) Establish an indicated standard rate turn in either direction. The initial bank should be established with reference to the attitude indicator. Make minor adjustments with reference to the rate of turn indicator to establish a standard rate turn.

(2) Check the second hand of the clock as heading indicator passes any 30° point.

(3) Check elapsed time after 30° of turn (10 seconds ± 1 second).

(4) Any deviation is corrected by adjusting rate or turn until a turn of 3° per second is established.

(5) Note the position of the properly calibrated needle and use this in subsequent timed turns.

(6) Roll into a turn in the opposite direction and repeat steps (1) through (5).

b. Timed turns.

(1) Turns of 20° or more of desired change of direction.

(a) Calculate time required for the turn (3° per second).

(b) Start turn as the second hand of the clock passes a cardinal point (12, 3, 6, 9) with a coordinated application of controls.

(c) Maintain a standard rate turn (3° per second) until the total calculated time has elapsed.

(d) Coordinated roll-out to straight and level flight. (Roll-in and roll-out must be at the same rate.)

(2) Turns of less than 20^{o} will be accomplished with the procedures shown in 2b(1) above, except the rate of turn will be one-half standard rate ($1\frac{1}{2}^{o}$ per second).

COMPASS TURNS

1. Definition. Compass turns are turns made to various magnetic headings using the emergency panel minus the clock. Compass turns error is an amount of lead or lag that must be used when turning to a heading of north and south varying with the equal to the latitude at this locality.

2. Maneuver procedure. Turns terminating in north or south involve the maximum error, equal to the degree of latitude, in this case 30^{o}. Since the compass turns slower than the aircraft when turning through north from east or west, and faster than the aircraft when turning through south, the effect cancels and no error is present at east or west. Therefore, latitude error is determined by the number of degrees the heading varies from the zero (east or west) reference point. To simplify computation, use the following procedure:

a. Determine angular difference in degrees between east or west as appropriate and the desired heading.

b. The lead for roll-out must be computed in addition to the latitude error, the rule of thumb for computing the roll-out lead is: One-half the angle of bank added or subtracted to the latitude error.

c. Since 30^{o} of error is involved in 90^{o} of turn (1^{o} of error for 3^{o} of turn), divide the degrees of angular difference by three to determine latitude error.

d. In turns terminating in northerly quadrant, roll out early the amount of latitude error plus one-half the angle of bank. For southern quadrant, roll out after turning past the desired heading the amount of latitude error minus one-half the angle of bank.

e. Upon arrival at desired compass indication, roll out straight and level.

CLIMBING AND DESCENDING TURNS

1. Definition. Climbing and descending turns involve 180° change in heading, a 500 ft change of altitude. The maneuver combines a standard rate turn (3° per second) and a standard rate climb or descent (500 fpm). Climb is executed at 50 kts airspeed. Descent is executed at 60 kts airspeed. Properly executed, the maneuver will be accomplished in one minute. In this maneuver, the rate of climb or descent and the rate of turn are both checked against time. A very rapid cross-check throughout this maneuver is required for precise execution.

2. Maneuver procedure. With the aircraft established at cruise and on a given cardinal heading the maneuver is performed as follows:

a. When the second hand passes a cardinal point, a standard rate turn and a standard rate climb or descent are simultaneously entered. As power is adjusted to a predetermined setting, torque corrections should be made with pedals to maintain trimmed flight conditions.

b. The initial bank should be established with reference to the attitude indicator and the rate-of-turn indicator. To maintain the rate of turn, minor corrections should be made with reference to the rate-of-turn indicator. Proper pitch attitude is maintained by reference to the attitude indicator and the airspeed indicator.

c. During the climb or descent, the rate of turn, rate of climb, and airspeed are maintained with cyclic control. Trim is maintained with pedals, rate of climb or descent with power, and pitch attitude supported by airspeed. Power is used to adjust rate of climb or descent only if the desired airspeed must be changed by more than ± 5 kts to maintain a 500 fpm climb or descent.

NOTE: Max power available 33" MAP must be reduced to 27" within two minutes which may not produce desired rate of climb.

d. In cross-checking altitude and heading against time, a 15 second cross-check is used. After 15 seconds, the aircraft will have turned 45° and climbed 125 ft; after 30 seconds - 90° of turn and 250 ft of altitude; after 45 seconds - 135° of turn and 375 ft of altitude. In other words 45° of turn in relation to 125 ft of altitude for each 15 seconds. It should be noted, however, that the heading and altitude will be slightly behind the time throughout the maneuver because of the time involved during the entry process. Time starts when control pressures are initiated to start the maneuver and stops when control pressures are applied to terminate the maneuver. Disregarding time, recovery should be initiated to place the aircraft on the desired heading and altitude.

STEEP TURNS

1. Definition. The steep turn angle of bank (30°) is a not to be exceeded figure. The 3 to 3½ needle width is the standard steep turn angle of bank. This will generally give an angle of bank of 22° to 24° which meets the criteria for a steep turn. Definition of a steep turn: Any turn greater than standard rate is considered a steep turn.

2. Maneuver procedure. The technique of entry and control during the turn and recovery are the same as used in a standard rate turn.

a. Entry to the maneuver is made with a coordinated roll into an angle of bank required to maintain a steep turn. Angle of bank should be constant after the bank has been established.

b. During the turn a rapid cross-check is required to maintain a constant bank and airspeed. Power may be required to prevent loss of airspeed in the turn.

c. Recovery from the maneuver should be made with a smooth roll-out. A rapid cross-check must be used during the after recovery from this maneuver. Recovery technique is the same as recovery from a standard rate turn.

RECOVERY FROM UNUSUAL ATTITUDE

1. Definition. Any attitude not required for normal instrument flight which may be caused by turbulence, vertigo, instrument failure, or carelessness.

2. Maneuver procedure. Upon detection of an unusual attitude, a recovery to straight and level flight should be made immediately, with minimum loss of altitude, minimum change of heading, and navigation resumed.

a. To recover from an unusual attitude, correct the bank and pitch attitudes and adjust power. For all practical purposes these are corrected simultaneously.

b. Care must be taken to prevent overcontrolling.

c. Avoid zero airspeed maneuvers.

HYDRAULIC BOOST FAILURE

1. Definition. Hydraulic Boost Failure is loss of the control boost system and will be evident by feedback forces being transmitted to the controls.

2. Maneuver procedure. Hydraulic Boost Failure is simulated by turning off the hydraulic system switch. The procedure to follow is:

a. Reduce airspeed to 50 kts.

b. Check hydraulic system circuit breaker in.

c. Check hydraulic system switch on RECYCLE (turn off if power not restored).

d. Contact control agency, inform them of situation, and state intentions.

e. Land as soon as practical.

AUTOROTATIONS (Forced Landings)

1. Definition. The term used to describe a descent without power in a helicopter.

2. Maneuver procedure. In event of power failure or other emergencies requiring autorotation, prompt corrective action must be taken to insure positive control of the aircraft. Instructor pilots will initiate forced landings by slowly reducing engine rpm to 2300 and stating forced landing.

a. Collective pitch must be reduced smoothly to maintain safe rotor rpm; pedals must be trimmed to assure coordinated flight. The attitude of the aircraft should be wings level and the airspeed adjusted to the autorotative speed (60 kts).

b. [redacted]. Check rotor rpm in the green, and repeat this to the instructor. Turn will be stopped prior to initiating recovery, (300 ft above desired altitude).

c. Practice autorotations will be terminated with a power recovery. Recovery is begun so as to stop the descent at a desired altitude. A lead of 200 ft is recommended to prevent overcontrolling the aircraft.

d. Recovery is accomplished by adjusting collective pitch to bring the rotor rpm within the engine rpm limits, then power is applied to join the needles and manifold pressure is increased to desired power setting. Pedals must be trimmed to maintain coordinated flight during power application. Maintain altitude, airspeed, and heading until given further instruction.