ROMERO

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STANDARDIZATION OF HELICOPTER MANEUVERS

UH-1 A, B, C, D, H.

ROMERO

ABOVE THE BEST

REVISED
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DEPARTMENT OF ROTARY WING TRAINING
UNITED STATES ARMY AVIATION SCHOOL
FORT RUCKER, ALABAMA

This document supersedes all previous editions.

Throughout all maneuvers, the use of forced stick trim will be optional.

Engine rpm for all maneuvers described herein will be 6400 rpm for the UH-1A model and 6600 rpm for the UH-1B, C, D, and H series.

Due to the configuration of the UH-1C, climbs and descents should be made at 80 knots and normal cruise at 100 knots; however, for training purposes, the flight commander may teach a 60-knot climb and descent and an 80-knot cruise.

For amplification of the maneuvers contained herein, consult TM 1-260.

STANDARDIZATION OF HELICOPTER MANEUVERS UH-1 A, B, C, D, AND H

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OF
HELICOPTER MANEUVERS
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PART I. MANEUVERS

1. TRAFFIC PATTERN

a. Required.

(1) Initial climb - 60 knots.

(2) Altitude - as directed.

(3) Airspeed - 80 knots.

b. Analysis of maneuver. After takeoff, climb straight ahead at 60 knots to 300 feet above ground level (AGL), turn on the crosswind leg, and continue to climb at 60 knots. (The downwind turn may be made as the crosswind turn is completed, after reaching traffic altitude, or started so that traffic altitude and 80 knots are reached as the turn is completed.) With due care for the helicopters being followed in the traffic pattern and for the spot of intended landing, turn on the base leg. Throughout the base leg, decrease the power required to lose altitude steadily while decreasing airspeed to 60 knots. Plan the turn from the base leg to approach leg to align the helicopter with the selected lane at 300 feet AGL and 60 knots.

c. Wind drift correction.

(1) On takeoff leg below 50 feet, make wind drift correction, by slipping the helicopter into the wind; above 50 feet, use the crabbing technique.

(2) Above 50 feet on the approach leg, make wind drift correction by crabbing or slipping. Below 50 feet, make wind drift correction by slipping helicopter into the wind. On the crosswind, downwind, and base legs, make wind drift correction by crabbing helicopter into the wind.

2. TAKEOFF TO HOVER

a. Required.

(1) Pretakeoff check completed.

(2) Vertical ascent.

(3) Constant heading.

(4) Stabilize at a 3-foot hover.

b. Analysis of maneuver. Place cyclic control in the NEUTRAL position. Increase collective pitch control with a smooth, constant, positive pressure until hovering altitude of 3 feet is reached. Apply antitorque pedal to maintain heading as collective pitch is increased. As the helicopter breaks ground, make minor corrections with cyclic control to insure a vertical ascent and apply antitorque pedals to maintain directional control. During ascent, maintain throttle full open.

7. NORMAL TAKEOFF

a. Required.

(1) Pretakeoff check completed.

(2) Execute 90° clearing turn prior to takeoff.

(3) Maintain constant heading and ground track.

(4) When climb is established—

(a) Use 60-knot airspeed.

(b) Adjust power to establish the desired rate of climb under different load-and-density altitude conditions. The desired rate of climb is 500 feet per minute (fpm).

b. Analysis of maneuver.

(1) From a hover.

(a) From a normal hover at 3-foot altitude, apply forward cyclic pressure to accelerate smoothly into effective translational lift; maintain heading with antitorque pedals. Maintain hovering altitude with collective pitch until effective translational lift has been obtained and the ascent has begun. Then, smoothly apply cylic to attain an attitude that will result in an increase of airspeed to 60 knots. Adjust power as required to establish the desired rate of climb.

(b) Stabilize airspeed and power as quickly as a smooth rate of acceleration will permit.

(2) From the ground.

(a) Place cyclic control slightly forward of neutral. Simultaneously increase collective pitch, maintaining directional control with antitorque pedals. As the aircraft leaves the ground, accelerate forward at the minimum altitude commensurate with terrain and obstacles until effective translational lift is attained. Smoothly apply cyclic to attain an attitude that will result in an increase of airspeed to 60 knots. Adjust power as required to establish the desired rate of climb. This maneuver may also be performed as a takeoff from a low hover.

(b) Stabilize airspeed and power as quickly as a smooth rate of acceleration will permit.

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

8. STRAIGHT-AND-LEVEL FLIGHT

a. Required.

(1) Maintain constant altitude.

(2) Constant airspeed of 80 knots.

(3) Constant ground track.

b. Analysis of maneuver.

(1) In straight-and-level flight, control attitude and airspeed with cyclic. Maintain altitude with the collective pitch control. Coordinate antitorque pedals with power changes to maintain a constant heading.

(2) To effect proper pedal trim, level helicopter laterally with cyclic control and apply antitorque pedal as required to center needle and ball of turn-and-bank slip indicator.

(3) In a crosswind, maintain a straight ground track by crabbing the helicopter.

9. NORMAL CLIMB

a. Required.

(1) Maintain constant ground track.

(2) Constant airspeed of 60 knots.

(3) Rate of climb of 500 fpm.

b. Analysis of maneuver. Airspeed and attitude are controlled with the cyclic. Collective pitch is used to adjust power to establish the desired rate of climb. Antitorque pedals are coordinated with power changes to maintain constant heading and trim.

10. NORMAL DESCENT

a. Required.

(1) Maintain constant ground track.

(2) Airspeed of 60 knots.

(3) Power reduction to establish the desired rate of descent of 500 fpm.

b. Analysis of maneuver. Coordinate power, cyclic control, and antitorque pedals smoothly to maintain a constant ground track and to establish a 500 fpm rate of descent and a pitch attitude that will gradually decrease airspeed to 60 knots.

11. LEVEL TURNS

a. Required.

(1) Airspeed of 80 knots.

(2) Constant attitude and degree of bank.

b. Analysis of maneuver.

(1) Govern the degree of bank by the rate of turn desired. Inititate turn by applying lateral cyclic control smoothly in the direction of turn and coordinating antitorque pedal with cyclic control. Once established, hold bank constant throughout the turn.

(2) Apply slight fore or aft cyclic control pressures to maintain a constant airspeed.

(3) Make corrections with collective pitch to maintain altitude. (Any change in power setting will require a pedal correction to maintain proper trim and constant rate of turn.)

(4) To return to straight-and-level flight on a desired heading, apply lateral cyclic control coordinated with sufficient antitorque pedal to roll the helicopter smoothly from banked to level attitude. Make necessary corrections with cyclic and collective pitch to maintain altitude and airspeed. Plan rollout so that all turning has stopped as the aircraft reaches a level attitude on the desired heading.

12. CLIMBING AND DESCENDING TURNS

a. Required.

(1) Constant rate of turn and degree of bank.

(2) 500 fpm for climb.

(3) 500 fpm for descent.

(4) Airspeed of 60 knots.

b. Analysis of maneuver.

(1) A climbing or descending turn is normally accomplished with a more shallow bank than a level turn, since the radius of turn is lessened by the slower airspeed of 60 knots.

(2) From normal climb or normal descent, initiate the climbing or descending turn by applying lateral cyclic control coordinated with antitorque pedal to roll the helicopter to the banked attitude that will result in the desired rate of turn. Once established, hold the bank constant throughout the turn.

(a) For a climbing turn, maintain a 500 fpm climb and proper trim with antitorque pedals. Maintain 60-knot airspeed with cyclic control. (If power setting remains constant, no pedal change should be required once bank is established.)

(b) For a descending turn, maintain 500 fpm descent and maintain proper trim with antitorque pedals. Maintain 60-knot airspeed with cyclic control. (If power setting remains constant, no pedal change should be required once bank is established.)

(3) To return to a straight climb or descent from the turn, apply lateral cyclic control and sufficient antitorque pedal to trim the helicopter. Maintain proper power setting and 60-knot airspeed. To complete the turn on desired heading, plan the rollout as from a level turn.

(4) To establish a climbing or descending turn from straight-and-level flight, smooth coordination of collective pitch, cyclic control, and antitorque pedals is required to establish a banked 60-knot attitude.

(5) To establish straight-and-level flight from a climbing or descending turn, coordinate controls smoothly as in (3) above.

13. NORMAL APPROACH

a. Required.

(1) Prelanding check - completed.

(2) Entry altitude - as directed.

(3) Entry airspeed - 60 knots.

(4) Approach angle - 8° to 10°.

b. Analysis of maneuver.

(1) To a hover. When the proper angle is intercepted, decrease collective pitch as required to establish and maintain the desired angle of descent. Maintain entry airspeed until such time as apparent groundspeed and rate of closure appear to be increasing. From this point, progressively decrease the rate of descent and forward speed to stop both descent and forward movement at a 3-foot hover over the intended landing spot. As forward speed is gradually reduced, apply additional power to compensate for the decrease in translational lift and to maintain the proper angle of descent.

(2) To the ground. Proceed as in the "approach to a hover," except that the descent is continued to the ground. Make the touchdown with zero groundspeed. Avoid either hard or excessively tail-low touchdown. Smoothly reduce collective pitch to minimum setting. Apply cyclic as necessary to level the rotor system.

14. FORCED LANDING PROCEDURE

a. Forced landing. A practice forced landing is a simulated emergency situation designed to develop the student pilot's proficiency, reaction time, and planning and judgment in case of engine failure during flight. It is intended to encourage the pilot to take full advantage of the many variables that are at his disposal to enable him to safely land the helicopter at a predetermined spot on the ground.

b. Analysis of maneuver.

(1) A practice forced landing will be initiated by the instructor pilot with a throttle reduction.

(2) The student will immediately lower the collective pitch to maintain rotor rpm in the green while simultaneously applying right pedal as required to properly trim the aircraft.

(3) An autorotative turn will be made toward the intended landing area. The approach to the selected area must be planned and executed in such a manner as to cause the final approach to be generally into the wind.

(4) Check rotor rpm and gas producer and call out (for example), "Rotor in the low green, gas producer 60 percent." The airspeed may be adjusted between 0 and maximum glide airspeed for aircraft being flown as required in order to reach a suitable touchdown area.

(5) Except for the necessary maneuvering into position, accomplish the autorotative approach and termination similar to a standard type autorotation. Adjust the forward speed at termination to permit a safe touchdown compatible with the terrain in the selected area.

c. Responsibility for making recovery from forced landing.

(1) 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 on the

ground by establishing a planned autorotative descent to a suitable area and accomplish a smooth touchdown commensurate with terrain.

(2) The decision for making a touchdown rests with the instructor pilot, but the student will plan each forced landing as continuing to the ground. Prior to reaching 100 feet of altitude, the instructor will state one of three commands: "POWER RECOVER," "TERMINATE WITH POWER," or "TOUCHDOWN."

(a) Power recovery.

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

2. Recovery is initiated immediately following the instructor pilot's spoken command of "POWER RECOVER."

3. May be ordered at any time after entering autorotation, but must be completed at an altitude that will enable the student to establish a normal climb prior to passing below 100 feet above the ground or the highest obstacle within the practice area.

4. Upon receiving the command, "POWER RECOVER," the student will immediately establish normal operating rpm while simultaneously maintaining proper trim of the aircraft with pedals. When the power has been regained, sufficient collective pitch will be applied to establish a normal climb.

(b) Termination with power.

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

2. May be ordered at any time after entering the autorotation, but must be given at an altitude that will enable the student to apply full power prior to passing through 100 feet of altitude above the ground or the highest obstacle within the practice area.

3. Upon receiving the command, "TERMINATE WITH POWER," the student will continue the autorotative descent. Prior to reaching 100 feet, he will establish normal engine rpm, trim the aircraft with pedal, and remain in autorotation. During the final portion of the approach, sufficient power and collective pitch will be applied to decrease the rate of descent to zero at an altitude of 3 to 5 feet above the ground with the helicopter in a landing attitude. Speed at this point should be the same as if an actual touchdown were to be effected. Proper trim of the aircraft will be maintained throughout the maneuver by use of pedals. An altitude of 3 to 5 feet will be maintained until the aircraft is brought to a stationary hover.

d. Night forced landing.

(1) Night practice forced landing. Night practice forced landings performed by students in areas other than at anoperational stagefield will be entered at an altitude not lower than 1000 feet above the ground. However, instructor pilot demonstrations of the maneuver may be initiated at altitudes not lower than 700 feet above the ground.

(2) Analysis of maneuver.

(a) Instructor pilot will initiate a practice forced landing at night by reducing the throttle.

(b) Student will immediately lower the collective pitch to maintain rotor rpm in the green and simultaneously apply sufficient antitorque pedal to trim the aircraft. Student will turn on and adjust the search and/or landing lights and continue as in a normal forced landing.

(c) Instructor pilot will insure that recovery is completed and a normal climb established no lower than 200 feet above the ground or the highest obstacle within the practice area.

15. DECELERATIONS (This maneuver is primarily designed to develop coordination of all controls, and is useful if a quick stop in flight is needed.)

a. Required.

(1) Entry airspeed - 80 knots.

(2) Minimum airspeed - 40 knots.

(3) Minimum altitude - 500 feet AGL.

b. Analysis of maneuver.

(1) Smoothly reduce collective pitch and simultaneously apply aft cyclic to decelerate to desired airspeed while maintaining altitude. Maintain trim by use of antitorque pedals.

(2) As airspeed decreases to that desired (not below 40 knots), simultaneously increase collective pitch to maintain altitude, trim aircraft, and apply forward cyclic necessary to accelerate to entry airspeed.

16. HOVERING AUTOROTATION

The hovering autorotation is a practice maneuver designed to develop the reaction time and skill required to recover from an engine failure while hovering.

a. Required.

(1) Head helicopter into the wind.

(2) Altitude not to exceed 3 feet.

(3) Vertical descent.

(4) Level surface for touchdown.

b. Analysis of maneuver.

(1) Close throttle to FLIGHT IDLE position. Simultaneously apply right pedal as required to maintain heading and apply cyclic control as required to maintain position over spot. (While closing the throttle, use caution not to raise or lower the collective pitch.)

(2) At approximately 1 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 FULL DOWN position. Apply sufficient cyclic to level the rotor system.

17. STANDARD AUTOROTATION

a. Required.

(1) Prelanding check - completed.

(2) Heading - into wind or in the direction of traffic.

(3) Entry altitude - as directed.

(4) Entry airspeed - 80 knots.

(5) Rotor speed - 285 to 314 rpm for A series (330 maximum); 294 to 324 rpm for B, C, D, and H (339 maximum).

b. Analysis of maneuver.

(1) Entry/altitude point. From an assigned altitude and point (at stagefields, this will be traffic pattern altitude, on final approach, and at the discretion of instructor pilot) with airspeed of 80 knots, reduce collective pitch to full down and simultaneously roll throttle off to the flight-idle detent. Maintain ground track by crabbing (above 50 feet) or slipping (below 50 feet) the helicopter, depending on the amount of crosswind. Adjust collective pitch only if the rotor exceeds the midgreen range. (Terminate the practice autorotation if the rotor decays below the green arc, 294 rpm.) Adjust cyclic control as necessary to maintain an attitude that will produce and maintain approximately 70 knots indicated airspeed until time of deceleration. Check rotor rpm in green and gas producer and call out (for example), "Rotor in the midgreen, gas producer 60 percent."

(2) Final autorotative descent and termination.

(a) At approximately 75 to 100 feet above the ground, apply aft cyclic control as necessary to initiate a smooth deceleration (as airspeed decreases, additional rearward cyclic pressure may be required to gain maximum deceleration effectiveness). Insure alignment of the aircraft with the runway by proper application of antitorque pedals and cyclic control. Position collective as required to prevent rotor rpm increasing above green arc. (Care must be exercised in attaining a decelerating attitude, so that the cyclic control is not moved rearward so abruptly as to cause the helicopter to climb or excessive rpm to build.)

(b) At approximately 10 to 15 feet, apply positive collective pitch to minimize the rate of descent and groundspeed. Adjust cyclic as necessary to avoid extreme tail-low touchdown. Use remaining pitch to cushion landing.

(c) After ground contact is made, continue collective pitch application as required, position cyclic as necessary, and maintain direction and heading. Minimum ground slide is desired; maximum is one helicopter length (50 feet).

CAUTION

Do not lower collective pitch to provide braking action.

18. 180° AUTOROTATION

a. Required.

(1) Prelanding check - completed.

(2) Entry altitude - as directed.

(3) Entry airspeed - 80 knots.

(4) Rotor speed - 285 to 314 desired for A series (330 maximum); 294 to 324 desired for B, C, D, and H (339 maximum).

(5) During descent - 180° turn.

b. Analysis of maneuver.

(1) Entry altitude/point. From an assigned altitude and point (at stagefields, this will be traffic pattern altitude, on downwind parallel with lane, and at the discretion of the instructor pilot) with airspeed of 80 knots, reduce collective pitch to full down and simultaneously roll throttle off to the flight-idle detent and trim aircraft. Adjust collective pitch only if the rotor exceeds the midgreen range. (Terminate the practice autorotation if the rotor decays below the green arc, 294 rpm.) Adjust cyclic control as necessary to maintain an attitude that will produce and maintain approximately 70 knots indicated airspeed until time of deceleration, and start a turn with coordination of cyclic control and pedals. Adjust degree of bank to insure rollout aligned with touchdown area. Check rotor rpm in the green and gas producer and call out (for example), "Rotor in the midgreen, gas producer 60 percent."

(2) Final autorotative descent and termination (same as standard autorotation).

CAUTION

Because of the inherent lag (approximately 4 seconds) in turbine power acceleration from the FLIGHT IDLE position to normal operating rpm, caution must be exercised in the performance of practice autorotations where the termination is either a "POWER RECOVERY" or "TERMINATION WITH POWER." The recovery must be initiated soon enough to preclude the possibility of a dangerous condition.

19. MAXIMUM PERFORMANCE TAKEOFF

a. Required.

(1) Pretakeoff check completed prior to beginning maneuver.

(2) 90° clearing turn prior to takeoff.

(3) Constant heading and ground track.

(4) Until clear of barrier (or 100 feet during practice), use—

(a) 40-knot airspeed attitude.

(b) Gas producer (N_1) 3 percent above hover power, not to exceed "go-no-go" limits.

(5) Clear left, right, and overhead prior to takeoff.

b. Analysis of maneuver. Place the cyclic control and antitorque pedals in a NEUTRAL position; then, slowly increase collective pitch. As the helicopter leaves the ground, continue to increase the collective pitch at a constant rate until maximum allowable N_1 is reached. Coordinate cyclic control and correlate antitorque pedals with power increase to insure the helicopter leaves the ground in a 40-knot attitude. Above 50 feet, crab the aircraft to maintain ground track. At an altitude of 100 feet or when the barrier is cleared, progressively increase airspeed and adjust power to establish a normal climb.

20. STEEP APPROACH

a. Required.

(1) Prelanding check - completed.

(2) Entry altitude - as directed.

(3) Entry airspeed - 60 knots.

(4) Approach angle - 12° to 15°.

b. Analysis of maneuver.

(1) Initiate the steep approach as in the normal approach, maintaining a steeper angle of descent. (To initiate the descent, a greater reduction of collective pitch is usually required at the beginning of the approach.) Correct for deviations from the desired line of descent by proper application of collective pitch.

(2) Maintain the entry airspeed until such time as apparent groundspeed and rate of closure appear to be increasing. From this point, progressively decrease the rate of descent and forward speed to stop both descent and forward movement

at the intended landing spot. As forward speed is gradually reduced, apply additional power to compensate for the decrease in translational lift and to maintain the proper angle of descent.

(3) Terminate the steep approach at a hover or to the ground in the same manner as the normal approach.

21. RUNNING LANDING

a. Required.

(1) Prelanding check - completed.

(2) Entry altitude - as directed.

(3) Entry airspeed - 60 knots.

(4) Approach angle - 5° to 8°.

(5) Smooth surface for touchdown.

(6) Effective translational lift at touchdown.

b. Analysis of maneuver. The approach should be shallow (5° to 8° angle). Maintain entry airspeed (60 knots) until such time as apparent groundspeed and rate of closure appear to be increasing. From this point, progressively decrease rate of descent and forward speed to facilitate a touchdown at or above effective translational lift speed, at intended touchdown point in first usable one-third of area. During touchdown, maintain directional control with cyclic and heading with antitorque pedals. After ground contact is established, slowly decrease collective pitch to minimize forward speed. Position cyclic as necessary to level rotor system. If braking action is desired, the collective pitch may be lowered as required for quicker stopping.

22. LOW-LEVEL AUTOROTATION

a. Required.

(1) Prelanding check - completed.

(2) Heading - into wind or in direction of traffic.

(3) Entry altitude - 50 feet.

(4) Entry airspeed - 80 knots (cruising).

(5) Rotor speed - maximum 330 for A series; 339 for C, D, and H.

b. Analysis of maneuver.

(1) In preparation for the low-level autorotation, start descent in turn from downwind leg of traffic, descending to an altitude of 300 feet AGL on base leg. Downwind leg should be planned in such a way to enable continued descent while on final to the autorotative entry altitude of 50 feet.

(2) From an entry altitude of 50 feet (actual altitude) with airspeed of 80 knots, simultaneously lower collective pitch to maintain the rotor in the green arc, and roll throttle off to the flight-idle detent, applying aft cyclic control pressure to effect a smooth deceleration to slow the forward groundspeed sufficiently to effect a minimum ground run.

(3) Final autorotative descent and termination (same as standard autorotation).

23. SLOPE OPERATION

a. General. Practice slope operations develop pilot proficiency for performing operations on inclined surfaces. A slope landing may often be necessary during confined area operations or during pinnacle and ridgeline operations.

b. Execution.

(1) The approach to a slope differs in no material way from the approach to any other landing area. Allowance must be made for wind, barriers, and forced landing sites. Since the slope will almost always constitute obstruction to wind passage, some turbulence and downdrafts must always be anticipated.

(2) (Slope landing should be made cross-slope with skid-type gear.) Make the slope landing by heading the helicopter generally cross-slope.

Descend slowly, placing the upslope skid on the ground first. Coordinate reduction of collective pitch with lateral cyclic (into the slope) until downslope skid touches the ground. Continue coordinating reduction of the collective pitch and application of cyclic into the slope until all the weight of the aircraft is resting firmly on the slope. Maintain directional control throughout the maneuver with antitorque pedals. If the cyclic control contacts the stop before the downslope skid is resting firmly on the ground, return to a hover and select a position where the degree of slope is not so great. After completion of a slope landing and after determining that the aircraft will maintain its position on the slope, place the cyclic in the NEUTRAL position.

NOTE: The cyclic is placed in the NEUTRAL position after landing to allow safe "head clearance" on the upslope side of the helicopter.

(3) The takeoff technique is the reverse of the landing technique. Apply lateral cyclic control into the slope. Apply collective pitch to raise the downslope skid first. Coordinate lateral cyclic control and collective pitch to bring the helicopter to a level attitude with the upslope skid still on the ground. After attaining a level attitude, continue increasing collective pitch to bring the aircraft to a hover. Maintain directional control throughout the maneuver with antitorque pedals.

24. RECONNAISSANCE

a. General application.

(1) A high and low reconnaissance are required before landing in any area without an established traffic pattern.

(2) A ground reconnaissance is required before maneuvering the helicopter on the ground or at a hover.

b. High reconnaissance.

(1) Required.

(a) Good vantage position for observation of area.

(b) Constant airspeed of 60 to 80 knots.

(2) Purposes.

(a) To determine suitability of the landing area.

(b) To locate barriers and estimate their effect on wind.

(c) To select a point for touchdown and plan the approach.

(d) To plan the flightpath for takeoff.

(3) Planning and execution. Upon approaching the area, make an overall evaluation of the area and surrounding terrain to select the flightpath for the high reconnaissance. (The altitude and pattern for the high reconnaissance will be governed by the terrain and availability of forced landing area. It should be low enough to permit study of the general area, high enough to afford a reasonable chance of making a successful forced landing in an emergency, yet not so high nor so distant as to prevent adequate study of the proposed landing area.)

c. Low reconnaissance. Conduct the low reconnaissance and the approach together (normally). When the approach is sufficiently near the proposed area for the pilot to study the area in detail and to distinguish small objects on the ground, the approach becomes a low reconnaissance. As the pilot approaches, he continues to study the immediate vicinity of his selected touchdown point. If successful completion of the landing is in doubt, a go-around must be accomplished before loss of effective translational lift or prior to descending below the barrier. Never land in an area from which a takeoff cannot be made.

d. Ground reconnaissance.

(1) Purpose. A ground reconnaissance is performed after landing to determine the suitability of the area for ground operations and to supplement the information of the high reconnaissance and the low reconaissance in determining a positive plan of action for executing the takeoff and climbout. (Some situations make it necessary to move the helicopter into position for takeoff from the point of landing.) A walking reconnaissance of the area can be performed if necessary; but normally, it is accomplished from the cockpit.

(2) Planning and execution.

(a) Determine the takeoff plan by evaluating surface wind, height of barriers, obstructions in the area, the shape of the cleared portion of area, and any other factor that may apply.

(b) After the plan for takeoff has been formulated, select an accessible route to the TAKEOFF position. (Clearance between the aircraft and existing obstacles must be adequate at all points along the path arc made by the antitorque rotor as the helicopter is pivoted on the horizontal plane.)

25. CONFINED AREA OPERATION

a. Definition. As used here, a confined area is any area where the flight of the helicopter is limited in some way by the presence of obstructions, natural or manmade.

b. Elements included in operation.

(1) High reconnaissance.

(2) Prelanding check completed.

(3) Normal to steep approach into specified area.

(4) Low reconnaissance.

(5) Ground reconnaissance.

(6) Confined area takeoff from the area.

(7) Gas producer N_1 not to exceed "go-no-go" limits. Alternate procedure - hover takeoff data check.

(8) Clear left, right, and overhead prior to takeoff.

c. Execution.

(1) Approach.

(a) During the high reconnaissance, plan the approach by taking into consideration several different and sometimes conflicting factors. Account for wind conditions and the best possible advantage to be obtained from them. Consider the height of barriers, finding the point's lowest obstruction—the most desirable point of entry into the area under favorable wind conditions. Where possible, plan flightpaths to place the helicopter within reach of those areas most favorable for a forced landing.

(b) Select the point of touchdown in the forward usable third of the area. The touchdown point must be in sight prior to beginning final approach descent.

(c) The angle of descent should be steep enough to permit clearance of the barrier, but never greater than a steep approach.

(d) Terminate the approach on the ground when surface conditions permit.

(2) Low reconnaissance. Perform the low reconnaissance on the approach.

(3) Ground reconnaissance. Before the helicopter is operated within the area, make a thorough ground reconnaissance to determine suitability of the area.

(4) Takeoff.

(a) For takeoff over a barrier, it may be necessary to move the helicopter downwind the maximum distance permitted by surrounding obstacles.

(b) Use amount of power necessary to clear the barrier, maintaining a constant angle of climb. (Clearing a barrier by a narrow margin with a reserve of power is more desirable than clearing it by a wide margin with maximum power.)

26. PINNACLE AND RIDGELINE OPERATIONS

a. Definition. A pinnacle is an area from which the ground drops away steeply on all sides. A ridgeline is an area from which the ground drops away steeply on one or two sides such as a bluff or precipice.

b. Required elements of operation.

(1) High reconnaissance.

(2) Prelanding check completed.

(3) Pinnacle approach.

(4) Low reconnaissance (during approach).

(5) "Airspeed over altitude" takeoff.

(6) Clear left, right, and overhead prior to takeoff.

NOTE: The pinnacle approach may be varied between a shallow to steep approach, taking into consideration the wind velocity, density altitude, load, and available forced landing areas.

c. Execution.

(1) Execute the climb to a pinnacle or ridgeline on windward side of area, when practicable, so that advantage may be taken of updraft. Termination should be planned to the ground unless landing area is unsuitable for touchdown.

(2) Terminate an approach to a pinnacle or ridgeline with the point of touchdown well forward on the area to avoid the region of severe turbulence on the upwind end and the downdraft at the downwind end. (The low reconnaissance must be thorough and positive so that the approach can be aborted, if necessary, before the aircraft is committed to the landing.) Exercise extreme caution during touchdown on uneven or rough terrain. Place skids lightly on ground while maintaining sufficient

collective pitch to keep aircraft light on skids. Check security of helicopter as pitch is decreased. When satisfied that the helicopter is setting firmly on the ground, complete the landing.

(3) Ground movement of the helicopter is seldom necessary since takeoff is generally made from a forward portion of the area.

(4) An "airspeed over altitude" takeoff is made because the area is higher than the surrounding ground. Gaining altitude on takeoff is of secondary importance to that of gaining a safe airspeed. In addition to covering the unsafe ground quickly, a high airspeed will afford a more favorable glide angle and thus contribute to the chances of reaching a suitable area or, if no area is available, of executing a flare successfully and reducing forward speed prior to landing in event of an engine failure.

27. LOAD OPERATIONS

Load operations are designed to simulate actual missions that the aircraft may be required to perform as part of its military capabilities. The helicopter will be loaded within center-of-gravity limitations and under maximum allowable gross weights in accordance with the Operator's Handbook.

a. Takeoff with loads (internal).

(1) Required.

(a) Pretakeoff check completed.

(b) Gas producer (N_1) not to exceed "go-no-go" limits at a 2-foot hover. Alternate procedure, hover takeoff data check.

(c) Heading into wind or in direction of traffic.

(d) Clear left, right, and overhead prior to takeoff.

(2) Analysis of maneuver. Place cyclic control slightly forward of neutral. Simultaneously increase collective pitch, maintaining directional control with antitorque pedals. As the aircraft leaves the ground, accelerate forward at the minimum altitude commensurate with terrain and obstacles until effective translational lift is attained. Smoothly apply cyclic to attain an attitude that will result in an increase of airspeed to 60 knots. Adjust power as required to establish the desired rate of climb. This maneuver may also be performed as a takeoff from a low hover.

b. Normal approach with loads (internal).

(1) Required.

(a) Prelanding check - completed.

(b) Heading - into the wind or in direction of traffic.

(c) Entry altitude - as directed.

(d) Entry airspeed - 60 knots.

(e) Approach angle - approximately 8° to 10°.

(2) Analysis of maneuver. When proper angle is intercepted, decrease collective pitch as required to establish and maintain the desired angle of descent. Maintain entry airspeed until such time as apparent groundspeed and rate of closure appear to be increasing. From this point, progressively decrease the rate of descent and forward speed to stop both descent and forward movement at this intended landing spot. As forward speed is gradually reduced, apply additional power to compensate for decrease in translational lift and to maintain the proper angle of descent. Terminate approach to the ground if landing surface permits.

c. Takeoff with external loads.

(1) Required.

(a) Pretakeoff check completed.

(b) Vertical ascent until load clears the ground.

(c) Gas producer (N_1) not to exceed "go-no-go" limits with load 2 feet above ground.

(d) Clear left, right, and overhead prior to takeoff.

(2) Description of maneuver. Hover over load. When load is attached, increase collective pitch, simultaneously maintaining rpm, if necessary, with rpm increase-decrease switch until load clears the ground. (Remainder of takeoff is performed as in a(2) above.)

d. Approach with external loads.

(1) Required.

(a) Heading - into the wind or in direction of traffic.

(b) Altitude - as directed.

(c) Approach angle - 8° to 10°.

(d) Entry airspeed - 60 knots.

(2) Analysis of maneuver. When the proper angle is intercepted, decrease collective pitch to initiate approach. Adjust collective pitch to hold a constant angle of descent. Maintain entry airspeed until apparent groundspeed or rate of descent appears to increase. At this time, begin deceleration until reaching zero groundspeed at an altitude which is just high enough for the load to clear the ground. (As airspeed is being dissipated toward the end of the approach, care must be exercised that sufficient collective pitch is maintained to slow the rate of descent and finally to stop the aircraft.) Reduce hovering altitude until weight of load is on the ground; then, release the load.

28. HIGH OVERHEAD APPROACH

a. Required.

(1) Prelanding check - completed.

(2) Entry altitude - 1500 feet above terrain or mission altitude.

(3) Entry airspeed - 80 knots.

(4) Rate of descent - maximum 1500 fpm.

(5) Rotor rpm - maintain within limits.

(6) Coordinated turn - maintained in descent.

(7) Final approach - into the wind or direction of traffic.

(8) Angle of bank - maximum 45° (30° loaded aircraft).

b. Analysis of maneuver. Lower the collective pitch to effect a maximum rate of descent (1500 fpm). Establish an 80-knot attitude with cyclic and coordinate turn with proper application of antitorque pedals. While executing a series of coordinated descending turns, planning and judgment should be exercised to insure that final approach to the area is into the wind. Apply collective pitch and aft cyclic to slow the rate of descent to effect a deceleration for the last 200 feet of the approach. Maintain rotor rpm within the green arc with collective pitch. Termination of the approach will be the same as explained in confined area operations.

29. PRECISION AUTOROTATION (Familiarization Only)

a. Required.

(1) Prelanding check - completed.

(2) Heading - into wind or direction of traffic.

(3) Entry altitude - as directed.

(4) Entry speed - 80 knots.

(5) Rotor rpm - maintain within limits.

(6) Touchdown - on predetermined spot. (Maximum ground slide desired is one helicopter length, 50 feet.)

b. Analysis of maneuver. Five variables are at the disposal of the pilot to effect precision termination.

(1) The initial point of entry may be varied after estimating the angle of descent. Wind, load, and other influencing factors will be considered in determining the exact point to enter autorotation.

(2) During the initial descent, the airspeed can be varied to maintain a line of descent to the point two or three helicopter lengths short of the touchdown point.

(3) Rotor rpm may be varied from the minimum area of the green arc upward so as not to exceed the red line. Within limits, minimum rpm will cause the glide to be extended. Maximum rpm will result in the glide being shortened. Rpm and airspeeds required for maximum glide and minimum rate of descent operations vary with the series of aircraft. Refer to appropriate -10 for rpm and airspeed figures. Check rotor rpm and gas producer and call out (for example), "Rotor in the low green, gas producer 60 percent."

(4) The deceleration attitude may be varied to touchdown on a predetermined spot at the desired forward speed.

(5) The rate of application of collective pitch and the attitude of the helicopter may both be varied slightly to shorten or extend the final portion of the autorotative descent. To shorten the glide, a slightly tail-low attitude must be maintained, and application of collective pitch must be more positive to slow the helicopter. To lengthen the glide, the helicopter must be held in a more level attitude, and application of pitch must be more gradual to prevent dissipation of forward speed.

30. SIMULATED GOVERNOR FAILURE

The following procedures apply for instruction in governor failure operations:

a. High-side failure (oral only). Increase collective pitch immediately to "load" the rotor system and prevent engine/rotor overspeed, while simultaneously reducing throttle from the FULL-OPEN position to a point where manual control is gained. Adjust power and rpm manually. Do not move the governor switch into the EMER position since this serves no useful purpose other than to bypass the automatic unit (from which the pilot has already taken control manually). Under these conditions, the pilot is not required to closely monitor N_1 or exhaust gas temperature (EGT) during acceleration, deceleration, or constant-speed operations, since there is no possibility of accelerating or decelerating the engine too rapidly, and the control will automatically maintain whatever N_1 the pilot requests through the twist grip. The pilot must constantly monitor N_2 to maintain desired engine/rotor rpm.

b. Low-side failure (on the ground/at a hover).

(1) While on the ground, the instructor will reduce the throttle until an indication of a power reduction is apparent; then move the governor switch to the EMERGENCY position. A further reduction of N_1 should be noted, and the rpm should then be increased manually with the throttle. All

throttle adjustments should be made smoothly to preclude flameout, compressor stall, or engine overtemperature/overspeed. The N_2 rpm should be stabilized at approximately 200 below operating rpm, and the instructor must stress the precautions to be taken when applying pitch and throttle without the correlation device.

(2) The student will practice throttle control on the ground and during hovering flight. The instructor will closely monitor N_1, N_2, and EGT during ground and hovering operations. To reestablish AUTO governor from the EMERGENCY position, land the helicopter, synchronize the rpm manually to the same rpm at which the governor was last adjusted (beeped), return the switch to the AUTO position, and advance the throttle manually to the FULL-OPEN position.

c. Low-side failure - in-flight.

(1) Practice in-flight procedures will be conducted in the traffic pattern and initiated on the downwind leg.

(2) "When on the downwind leg, the governor increase-decrease switch will be activated to normal operating rpm, and the throttle, subsequently, reduced manually to maintain 200 rpm less than normal operating rpm. The governor switch will remain in the AUTO position. The aircraft will then be flown through a complete normal approach and landing. To reestablish normal operating rpm, increase the throttle to the FULL-OPEN position manually."

31. HYDRAULIC POWER FAILURE

Hydraulic power failure is not generally apparent until a control movement is executed or the aviator sees the master caution panel lights. The forces required to initiate movement of the controls are increased, and moderate feedback will be felt through the controls. The aircraft can be flown with the hydraulic power inoperative. In the event of hydraulic failure, the procedures to follow are listed below:

a. Airspeed - ADJUST as desired to obtain most comfortable control movement level.

b. Hydraulic control circuit breaker - OUT, check for electrical failure of hydraulic control switch.

c. Hydraulic control circuit breaker - IN, if electrical failure of hydraulic control switch has been eliminated an' actual hydraulic control failure has been confirmed.

d. Hydraulic control switch - recycle, ON (OFF if power is not restored). Reset MASTER CAUTION LIGHT.

e. Contact a control agency and advise the agency of hydraulic failure.

f. Land as soon as practical (generally the nearest airfield or an area suitable for a running landing).

g. The approach should be shallow (5° to 8° angle). Maintain entry airspeed (60 knots) until such time as apparent groundspeed and rate of closure appear to be increasing. From this point, progressively decrease rate of descent and forward speed to facilitate a touchdown at or above effective translational lift speed, at intended touchdown point in first usable one-third of area. During touchdown, maintain directional control with cyclic and heading with antitorque pedals. After ground contact is established, slowly decrease collective pitch to minimize forward speed. Position cyclic as necessary to level rotor system. If braking action is desired, the collective pitch may be lowered as required for quicker stopping.

32. ENGINE FAILURE

The altitude and airspeed at which engine failure occurs dictate the action to be taken to effect a safe landing.

a. Engine failure while hovering or on takeoff. If engine fails at hovering altitude, the aircraft will settle. Hold collective pitch in the same position used while hovering. Apply right pedal to avoid a left turn while landing. Maintain position over spot with cyclic control. Just before ground contact, increase collective pitch to cushion landing. If engine failure occurs during initial part of takeoff, proceed as above, but do not attempt to stop forward movement. Make touchdown as near a level attitude as possible.

b. Engine failure in flight. Accomplish autorotative landing as outlined in section I, paragraph 14. If time and altitude permit, turn off fuel and engine switches, and lock shoulder harness prior to touchdown.

33. ENGINE FIRE DURING STARTING

a. Internal (hot start). Internal fire may be caused by overloading of fuel in the combustion chamber. It may be detected by flames emitting from the tailpipe or by excessive EGT readings. To extinguish the fire, proceed as follows:

(1) Continue to depress starter switch and roll throttle closed.

(2) Start fuel off (if applicable).

(3) Main fuel off.

(4) As EGT decreases to normal, complete shutdown and record limit and duration of hot start on DA Form 2408-13.

b. External. External fire can be detected by the fireguard and/or the illumination of the fire detection system. Proceed as follows:

(1) Close throttle.

(2) Complete shutdown.

(3) Exit the aircraft.

(4) Use fire extinguisher.

34. SIMULATED ANTITORQUE FAILURE

a. Required.

(1) Prelanding check.

(2) Entry airspeed of 80 knots.

(3) Entry altitude as directed.

(4) Approach angle of 5° to 8°.

(5) Fixed pedal setting (right, left, or neutral).

(6) Approved landing area.

b. Analysis of maneuver.

(1) Right pedal setting.

(a) Instructor pilot will depress the right pedal until a right out-of-trim condition exists (one ball width). He will maintain the antitorque pedals in this position during the remainder of the maneuver. The student will place his feet on the cockpit floor and continue to fly the aircraft with the cyclic, collective, and throttle. With the governor switch in the AUTOMATIC position, reduce the throttle to obtain manual control and maintain approximately 200 rpm below operating rpm by use of throttle. Maintain normal traffic and execute a shallow approach of 5° to 8° maintaining at least 60 knots airspeed during the initial part of the approach. 6400

(b) At approximately 50 feet to 75 feet (and when landing area can be made), start a slow deceleration to arrive at the intended landing point with approximately 30 knots indicated airspeed.

(c) At approximately 3 feet, slowly reduce the throttle to overcome yaw effect and allow aircraft to settle. When aircraft is aligned with intended area, allow aircraft to touchdown. After ground contact is established, slowly decrease collective pitch to minimize forward speed. If aircraft starts to turn, position cyclic as necessary to follow turn until aircraft has come to a complete stop.

NOTE: Instructor pilot may terminate maneuver by applying antitorque pedals as necessary to keep aircraft from going off lane.

(2) Left pedal setting.

(a) Instructor pilot will depress the left pedal until a left out-of-trim condition exists (one ball width). He will maintain the antitorque pedals in this position during the remainder of the maneuver. The student will place his feet on the cockpit floor and continue to fly the aircraft with the cyclic, collective, and throttle. With the governor switch remaining in the AUTOMATIC position, reduce the throttle to obtain manual control and maintain approximately 200 rpm below operating rpm by use of throttle. Maintain normal traffic and execute a shallow approach of 5° to 8° maintaining at least 60 knots during the initial part of the approach.

(b) Approximately one-third of the way down the final approach leg, reduce throttle to minimum operating rpm and simultaneously begin a slow deceleration so as to arrive at a point approximately 2 feet above the intended touchdown area as effective translational lift is lost.

(c) As effective translational lift is lost, apply collective pitch (maintaining minimum operating rpm) to stop rate of descent, forward speed, and align aircraft with intended landing area. If aircraft is not aligned after pitch application, throttle may be increased to further help with alignment. Allow aircraft to touchdown maintaining lane alignment with throttle (0 groundspeed).

(3) Neutral pedal setting.

(a) Instructor pilot will maintain the pedals in a NEUTRAL position during the remainder of the maneuver. The student will place his feet on the cockpit floor and continue to fly the aircraft with the cyclic, collective, and throttle. With the governor switch in the AUTOMATIC position, reduce the throttle to obtain manual control and maintain 200 below operating rpm by use of throttle. Maintain normal traffic and execute a shallow approach of 5° to 8° maintaining at least 60 knots airspeed during the initial part of the approach.

(b) At approximately 50 feet to 75 feet (and when landing area can be made) start a slow deceleration to arrive at the intended landing point with approximately 30 knots indicated airspeed.

(c) At approximately 3 feet, slowly increase or decrease throttle as necessary to overcome yaw effect and allow aircraft to settle. When aircraft is aligned with intended landing area, allow aircraft to touchdown. After ground contact is established, slowly decrease collective pitch to minimize forward speed. Position cyclic as necessary to follow turn until aircraft has come to a complete stop.

35. PARTIAL POWER DESCENT FORCED LANDING (Demonstration Only)

a. Required.

(1) Prelanding check - completed.

(2) Entry altitude - 1000 feet indicated.

(3) Entry airspeed - 80 knots.

(4) Descent - 500 fpm.

b. Analysis of maneuver.

(1) Establish a partial power descent of 500 fpm maintaining 80 knots indicated airspeed. With cyclic, collective, and pedal controls held firmly in a stationary position, close throttle to flight-idle position. Note slight yaw and roll to left similar to result of wind gust. Monitor slow decay of rotor rpm to approximately 270 to 280 where it stabilizes. Angle of approach will remain constant with no noticeable indication of engine failure.

(2) Check rotor rpm for stabilization and call out (for example), "Rotor 270 rpm, gas producer 58 percent."

(3) Establish normal engine rpm, trim the aircraft with pedal, apply sufficient power and collective pitch to establish a normal climb prior to passing below 100 feet above the ground or the highest obstacle within the practice area.

36. 40-KNOT - MAXIMUM CLIMB ENGINE FAILURE

a. Flight at this low airspeed with power applied as high as 40 psi is normally outside the normal flight envelope, and should be avoided if possible; however, operational missions often require that flights be made under these conditions with a high gross weight. Power failure, then, becomes a very critical occurance, and we must have a thorough understanding of the normal reactions to expect, and of the approved recovery techniques.

b. Information contained herein will provide some insight into aircraft reactions and of the tested method of recovery.

c. Facts known from flight tests.

(1) Average reaction to evaluate and respond to power failure is 2 seconds <u>minimum</u>.

(2) During this 2-second period, rotor rpm will decrease considerably depending on airspeed and amount of power being used. At 40 psi torque and 40 knots, rotor rpm will drop to 220 to 240 rpm.

(3) Helicopter will also pitch up and yaw to the left if no further corrections are made during this period. However, a small amount of forward cyclic and about 2 to 3 inches of right pedal will correct this action. Pitch and yaw normally present no problems since aviators tend to correct for these reactions automatically.

(4) Helicopter will not start settling until after 3 to 5 seconds have passed, but rotor rpm decays very rapidly.

d. Recovery procedure. Immediately upon detection of power failure, reduce collective slightly, (DO NOT BOTTOM PITCH) simultaneously applying sufficient forward cyclic to attain 25° to 30° glide angle. As airspeed and rotor rpm is increased, collective may be further lowered to hasten recovery of rotor rpm. Avoid abrupt movements of collective which may increase rate of descent beyond recovery point. At approximately 100 feet AGL, initiate a rapid deceleration which will insure rotor rpm in green and reduce rate of descent to normal autorotation level. Termination should be accomplished in same manner as standard autorotation.

e. See paragraph 32 for additional information on engine failure.

37. ENGINE FAILURE - 25-FOOT HOVER

a. Hovering at this altitude is outside the normal operating envelope and should be avoided if possible. However, situations exist wherein it will be necessary to hover abnormally high in order to accomplish the mission. Whenever hovering at this altitude, be especially alert for power failure since instant reaction is necessary to successfully complete the autorotation.

b. Information contained herein will be helpful in assisting aviators.

c. Facts known from flight tests.

(1) Rotor rpm will remain in green arc if proper technique is used.

(2) Gross weight has little or no effect on rotor rpm prior to pitch pull.

(3) It takes the same time to touch down from 25 feet as 5 feet—approximately 5 seconds.

(4) Helicopter reaction is same as normal hovering autorotation.

d. Recovery procedure.

(1) When power failure is experienced at a high hover, lower collective pitch immediately about one-third of full travel, to avoid any significant loss of rotor rpm. DO NOT BOTTOM PITCH. Helicopter will settle at a very rapid rate after lowering the collective pitch. Initiate a positive pitch pull at 3 feet to 5 feet and cushion landing.

(2) By properly lowering the collective pitch the recommended amount, rotor rpm will normally remain within the green arc until pitch pull.

38. ENGINE SHORT-SHAFT FAILURE: Engine short-shaft failure is not a common malfunction. However, should it occur, the following information will be of benefit in assisting the pilot in accomplishing a safe landing.

a. Indication of short-shaft failure will be a rapid increase in engine rpm similar to the high-side governor failure. However, unlike the high-side governor failure, as collective pitch is applied to "load" the rotor system, a decrease in rotor rpm will occur.

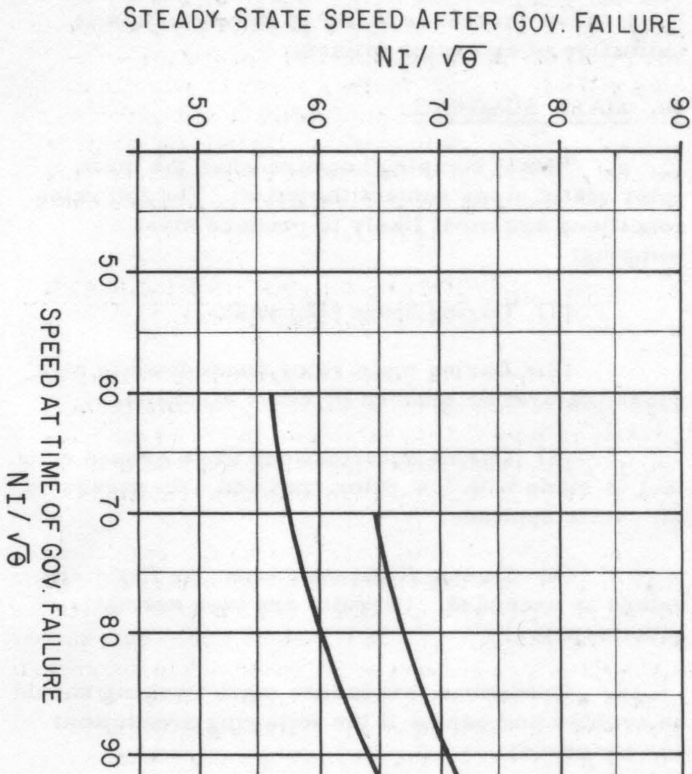
b. To prevent loss of rotor rpm below safe operating limits, the pilot must immediately reduce the throttle from the FULL-OPEN position to the FLIGHT-IDLE position and reduce the collective pitch to prevent further decay of rotor rpm. Establish an autorotational descent and select a suitable forced landing area. If time and altitude permit, shut engine down to prevent catastrophic failure. Accomplish autorotative landing as outlined in section I, paragraph 14.

39. LOW-SIDE GOVERNOR FAILURE INDICATION (T53-L-11 and -13 Series Engines)

a. A low-side governor failure is characterized by a reduction in fuel flow to the minimum governing flow. This minimum is, however, dependent on (1) the operating N1 speed at the time of governor failure and (2) the ambient conditions.

b. The following chart shows the results of a fuel control functional test in which a low-side governor failure was simulated. The point to which fuel flow was reduced was observed for various initial settings of corrected N1 speed. The corrected steady state N1 speed corresponding to this fuel flow was then determined. Data is presented for both the T53-L-11 and T53-L-13 series engine.

c. The chart also points out the difficulty of establishing a specific N1 speed that would result from a low-side governor failure. Since there are several factors that determine the N1 speed that would result, a range of N1 speed indicative of governor failure has been established.


STEADY STATE SPEED AFTER GOV. FAILURE
NI/ √θ
50
60
70
80
90
SPEED AT TIME OF GOV. FAILURE
NI/ √θ
50
60
70
80
90
100
T53-L-11
T53-L-13

d. If N1 speed stabilizes above 50 percent, this is indicative of a low-side governor failure. If N1 speed decreases below 50 percent, this is indicative of an engine failure.

40. MAST BUMPING

a. "Mast bumping" occurs when the main rotor static stops contact the mast. The following conditions are most likely to produce mast bumping:

(1) During slope operations.

(2) During main rotor coast down in high winds (natural or induced by other aircraft).

(3) During autorotations when ground contact is made with low rotor rpm and with excessive aft cyclic applied.

(4) During flight only when the flight envelope is exceeded. (Results are then normally catastrophic.)

b. Conditions that induce mast bumping should be avoided and can be if the following precautions are observed:

(1) Follow normal slope operation procedures as outlined in Standardization Memo 68-8 (UH-1 Slope Operations).

(2) Always place cyclic slightly into the wind during main rotor coast down.

(3) Avoid the combination of low rotor rpm, high rate of descent, and abrupt deceleration, during autorotations.

(4) Avoid any in-flight condition that requires an abrupt and excessive cyclic movement, especially when combined with low rpm.

c. Generally, the most important corrective measure to take if mast bumping occurs is to immediately center the cyclic.

41. GO-NO-GO PROCEDURES

a. The following diagram of the GO-NO-GO placard and related instructions are established in order to standardize instruction and utilization of the GO-NO-GO placard in UH-1 aircraft.

INSTRUCTIONS

(1) Obtain from Engine Historical Records and enter here. (Use pencil.)

(2) For 15°C, enter 97% of (1).

(3) For 25°C, enter 96.4% of (1).

(4) For 35°C, enter 95.6% of (1).

(5) For 40°C, enter 95.2% of (1).

(6) Cut out placard, peel off back, and apply to instrument panel so that arrow points to N1 gage.

FROM ENGINE HISTORICAL RECORDS

Maximum Nl rpm Std Day ______(1)______ %

Date Last Flight Checked for Nl Topping ________
________________.

For Departure From Confined Are Using Max Performance Technique Stabilize 2 Ft Hover at or Below:

(2) % Nl for 15°C.

(3) % Nl for 25°C.

(4) % Nl for 35°C.

(5) % Nl for 40°C.

For Normal T/O Add 1% Nl.

.25% Nl, 100 Lbs.

b. Takeoff from a confined area. To determine if sufficent power is available to safely execute a takeoff from a confined area using maximum performance technique, the following procedures apply:

(1) Check the percent of Nl required to maintain a stabilized 2-foot hover.

(2) Check the outside air temperature (OAT).

(3) Relate hover power and OAT to the GO-NO-GO placard.

(4) If the percent N1 required to hover at 2 feet does not exceed that listed on the placard for that OAT, the aircraft has sufficient power for exiting a confined area using maximum performance technique. (Note below applies.)

c. Normal takeoff. To determine if sufficient power is available for a normal takeoff, the procedures are as follows:

(1) Check the percent N1 required to maintain a stabilized 2-foot hover.

(2) Check the outside air temperature (OAT).

(3) Relate hover power and OAT to the GO-NO-GO placard.

(4) If the percent N1 required to hover does not exceed that listed on the placard for the appropriate OAT by more than 1 percent, the aircraft has sufficient power to execute a normal takeoff. (Note below applies.)

NOTE: If the OAT falls between the OAT's listed on the GO-NO-GO placard, read the percent N1 corresponding to the next higher temperature. DO NOT INTERPOLATE. If the percent N1 required to hover at 2 feet does not meet the criteria established in paragraphs b(4) and c(4) above, the load must be reduced.(.25 percent N1 - 100 pounds).

d. The UH-1 hover takeoff data check adopted for use by US Army Vietnam is performed as follows:

Pick up to 4 feet hover,

Maintain 6600 rpm (6400, UH-1A),

Return to ground,

Make normal takeoff.

Pick up to 10 feet hover,

Maintain 6600 rpm (6400, UH-1A),

Return to ground,

Make confined area takeoff.

Pick up to 25 feet hover,

Maintain 6600 rpm (6400, UH-1A),

Return to ground,

Make vertical takeoff.

CAUTION

Takeoffs must be made into the wind. Tests have shown that a takeoff made with a 2-knot tail-wind will require approximately three times the distance to clear a 50-foot obstacle as would be required if made into the wind.

(1) The go-no-go procedure is the primary procedure for determining if sufficient power is available to safely execute the desired type of takeoff.

(2) The hover takeoff data check and the go-no-go procedure will not be used in conjunction with each other.

(3) The hover takeoff data check will be demonstrated to the student by the instructor pilot as an alternate procedure to the go-no-go procedure as indicated below:

(a) As a demonstration maneuver during normal takeoffs with loads (4-foot hover).

(b) As a demonstration maneuver from a confined area (10-foot hover).

(c) As an oral briefing for vertical takeoffs (25-foot hover).

NOTE: Vertical takeoffs will not be performed during USAAVNS training.

e. If the GO-NO-GO placard is accurate and updated as prescribed in appropriate aircraft technical manuals, the go-no-go procedure provides for a smaller N1 reserve and a more accurate interpolation of available information than the hover takeoff data check.

NOTE: The hover takeoff data check is a simple, easy-to-understand field expedient for determining if sufficient takeoff power is available. However, under extremes of aircraft weight and climatic conditions, the hover takeoff data check may have marginal validity in determining if sufficient power is available to safely execute the desired type of takeoff.

2' - takeoff normal (all 2 minutes)

10' - small ground roll

25' - vertical departure 91% 6640 2 sec.

Engine Oil Pressure
min - 25 psi 80-100 psi
max - 100 psi

Gas Producer
101.5 max

A/S - 120 Knots max

Transmission Oil Pressure
min 30 psi
max - 70 ps 40-60 psi

[redacted]

Fuel Pressure
5-35 psi

Torque Pressure
50 psi max

Engine Oil Temp
93°C max

L-13 "H" only

390° - 610° cont

Transmission Temp
110°C max

610° - 625° 30 min

675° - 5 sec; 760° max

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