# SECTION II

# NORMAL PROCEDURES

## TABLE OF CONTENTS



## FLIGHT RESTRICTIONS

For limitations imposed on the helicopter, refer to Section V.

## FLIGHT PLANNING

The required fuel, airspeed, and power settings for take-off, climb, cruise, hover, and landing may be determined by reference to the performance data charts in Appendix I.

## TAKE-OFF AND LANDING DATA CARD

Complete the take-off and landing data card (figure A-41) according to the instructions in Appendix I. Items through Power Required to Hover will be completed for all flights. Other items are optional if they are known to be well in excess of mission requirements or are not required by the mission profile.

## WEIGHT AND BALANCE

The take-off and anticipated landing gross weight should be obtained prior to each mission and checked against WEIGHT LIMITATIONS, Section V, to determine if they are within specified limitations. Reference should be made to the Handbook of Weight and Balance, T.O. 1-B-40 and DD Form 365F for loading information. Insure that all passengers are seated in the cabin, all cargo has been properly loaded, and all equipment properly secured.

## PREFLIGHT INSPECTION

The pilot is responsible for insuring the preflight inspection is completed. He may delegate these tasks to other crewmembers. The preflight inspection outlined in this section is predicated on maintenance personnel completing the Aircraft Schedule and Maintenance Requirements, T.O. 1H-1(U)N-6WC-1 for pre-flight. When operating from remote areas where maintenance personnel are not available to perform these inspection requirements, the pilot will be responsible for accomplishing the pre-flight inspection in accordance with T.O. 1H-1(U)N-6WC-1.

## THROUGH-FLIGHT OPERATION

The through-flight operation may be accomplished when missions are assigned requiring intermediate landings, including shutdowns, by the same flight crew (no crew rest taken), and when no maintenance is performed during these stops. Through-flight items are indicated by an asterisk (*) up to STARTING ENGINES. These items must be accomplished during intermediate stops; additional items may be accomplished at the discretion of the pilot.

## *BEFORE EXTERIOR INSPECTION

1. Form 781 and flight publications - Check the form 781 for servicing and previous descrepancies and that applicable flight publications are aboard.

a. Auxiliary Fuel Equipment - Check fuel quantity and corresponding weight and balance.

**WARNING**

When aft auxiliary fuel tanks are used, any transfer of fuel to the main tanks will result in shifting C.G. forward. Loading the helicopter is a critical item to be observed during planning so that at no time during the mission will the C.G. limits be exceeded.

2. Battery switch - OFF.

3. Crew briefing - As Required.

## EXTERIOR CHECK DIAGRAM

1. Cabin Top.
2. Cabin Right Side.
3. Tail Boom Right Side.
4. Tail Boom Left Side.
5. Cabin Left Side.
6. Cabin Front.
7. All Covers/Tiedowns and Ground Wires

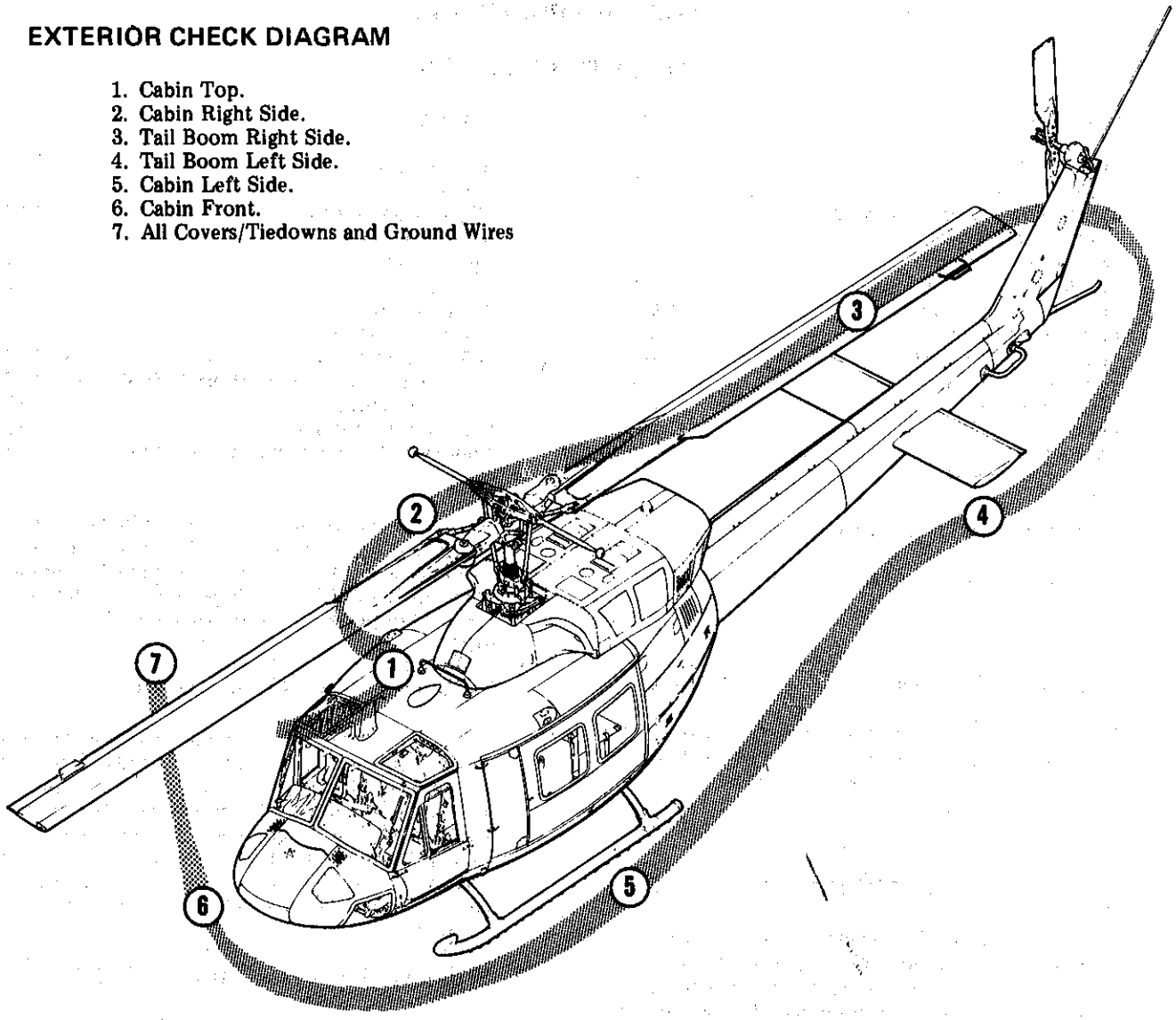



**Figure 2-1. Exterior Inspection diagram**

## EXTERIOR INSPECTION

The pilot will make a walk around inspection, checking for fuel and oil leaks, security of inspection panels and doors, and foreign matter such as ice, snow, or frost. The pilot will check the aft electrical compartments. Perform the exterior inspection in accordance with figure 2-1, and following steps.

1. Cabin Top - Checked.

**WARNING**

Do not stand on swashplate, cyclic pitch horns and/or collective levers during inspection. Dirt, trash, etc. on bottoms of footwear can cause cuts, nicks, and scratches in corrosion protective coating.

2. Cabin Right Side - Checked.
3. Tailboom Right Side - Checked.
4. Tailboom Left Side - Checked.
5. Cabin Left Side - Checked.
6. Cabin Front - Checked.
7. All covers, Tiedowns, and Ground Wires-Removed.

## INTERIOR AND BEFORE START

*1. Crew and Passengers - BRIEFED. (Refer to Section VIII.)

**WARNING**

Aircrew members will wear earplugs in addition to helmets on weapons firing missions.

2. Cabin Interior - CHECKED. Check passengers, cargo and equipment secured.

*3 Safety Belt, Shoulder Harness, Seat and Rotor Pedals — FASTENED and CHECKED.

*4. Ignition Keylock Switch — ON
Switch will remain on for duration of flight.

*5. Flight Controls — CHECKED.

a. Cyclic—observe proper movement of main rotor and then center cyclic.

b. Rotor pedals—confirm proper operation of tail rotor and then center pedals.

c. Collective — observe proper movement of main rotor and then confirm collective is down and unlocked.

**WARNING**

The proper operation of the main rotor and tail rotor must be confirmed prior to engine start.

6. Landing and Searchlight Switches — OFF.

7. All Radios — OFF (except KY28).

8. Loudhailer Switch — OFF.

9. Instructor Control Panel — AS REQUIRED.

10. Armament Switches — OFF.

*11. Engine and Fuel Control Panel — SET

a. Main Fuel Switches — OFF.

b. Crossfeed — AS REQUIRED.

c. Governor Switches — AUTO.

SEE SUPP 15-94 *

d. Particle Separator Switches — AUTO.

12. Auxiliary Fuel Transfer Pump Switches — OFF

*13. Miscellaneous Control Panel — SET.

a. Hydraulic Control Selector Switch — BOTH.

b. Hydraulic Control Master Switch — ON.

c. Force Trim Switch — ON.

14. IFF/SIF — OFF.

15. Compass Slaving — AS DESIRED.

*16. Altimeter — SET. Set to field elevation or present elevation if known and note setting.

17. Radar Altimeter — OFF.

18. Marker Beacon — OFF.

19. Fire Extinguisher Switch — OFF.

20. Fire Pull Handles — IN.

*21. Overhead Console Panel — SET.

a. Cargo Release Arm Switch — OFF.

b. Hoist Power Switch — OFF.

c. Windshield Wiper Switch — OFF.

d. Vent Blower Switch — OFF.

e. Heater Switches — OFF.

f. Formation Light Switches — OFF.

g. Interior Light Switches — OFF.

h. Generator Switches — OFF.

i. Non-essential Bus Switch — MANUAL.

j. Loudspeaker Switch — OFF.

k. Inverter Switch — OFF.

*22. Circuit Breakers — AS REQUIRED.

*23. ROTOR BRAKE Rotor Brake — OFF.

*24. Battery Switch — START.

Place the DC voltmeter selector in ESS BUS or NON ESS position and check battery voltage.

**CAUTION**

Battery starts attempted with battery below 23.5 volts may result in undetected engine overtemperatures during start. If battery voltage drops below 18 volts with the starter engaged, be particularly alert for a hot or stalled start. Battery starts should not be attempted with battery voltage below 20 volts.

*25. Battery Switch — OFF, External Power — ON. (If external power is utilized).

**CAUTION**

If external power voltage exceeds 29.5 volts, turn off external power immediately. The APU should be adjusted to provide lower voltage. Damage to the aircraft electrical system could occur at voltages above 29.5.

*26. Battery switch — ON (if external power voltage is 29.5 or below).

*27. Inverter — CHECKED (then OFF if battery start is to be made).

a. STBY — check AC voltage (115.0 ±2.5 volts).

b. OFF — check AC fail light (ON).

c. Main — check AC voltage (115.0 ±2.5 volts).

*28. Instruments — CHECKED. Check slippage mark, operating range and static position.

*29. Navigation/Anti-Collision Lights — AS REQUIRED.

30. Pax Alarm — CHECKED.

*31. Master Caution Light — RESET.

*32. Fire Warning Lights — CHECKED.

*33. Fuel Quantity Indicator — CHECKED (omit if battery start is to be made).

**WARNING**

The fuel quantity, fuel flow and low fuel warning indicators are not precise and should not be relied upon for an indication of a safe fuel reserve. The fuel quantity indicator may be in error by as much as 30 lbs.

*34. Gearbox Chip Detector Panel — CHECKED.

*35. Caution Panel — CHECKED.

*36. Primary Communications Radio — AS REQUIRED.

*37. ICS — SET AND CHECKED.

* STARTING ENGINES.

SEE SUPP 15-94 AMENDED

**WARNING**

To preclude possible hearing loss, aircrews should insure that all personnel within 30 feet of the aircraft wear hearing protection.

1. Throttles - CHECKED AND CLOSED.

**WARNING**

To prevent throttle interaction during all phases of flight, some throttle friction should be applied to each throttle. The friction should not be tightened to the point where they are difficult to move. This condition can be as hazardous as insufficient friction.

**NOTE**

Throttle pressure against the flight idle stop during an attempted shutdown will prevent plunger release and throttle closure.

a. Open throttle to ground idle.

b. Actuate flight idle stop switch.

c. Check full open.

d. Flight idle.

e. Flight idle release.

f. Set at full closed.

2. Beep Switch - DECREASE (hold 3 seconds)

3. Main Fuel Switches - ON.

4. Rotors - CLEAR.

SEE SUPP IS-94

5. Fire Guard - POSTED.

**NOTE**

During engine start and run-up, have the ground crew/flight mechanic inspect the transmission, engine, and combining gearbox compartments for leakage of fuel, oil or hydraulic fluids. Check hydraulic filter indicator for a "black" indication.

6. Engine - START.

a. Starter - ENGAGE.

b. Engine Oil Pressure - Indicating.

c. Throttle - At 12% Ng minimum, open to ground idle.

**CAUTION**

If ITT fails to rise within 15 seconds after opening the throttle, close the throttle and turn Main Fuel Switch and Starter OFF. Allow a 30-second fuel draining period, followed by a 15-second motoring run before attempting another start. If, for any reason, a starting attempt is discontinued, allow the engine to come to a complete stop and then accomplish a motoring run. Repeat the complete starting sequence, observing the starter limits.

d. ITT - Monitor.

**CAUTION**

If ITT exceeds 1090° C, move the throttle to OFF position and discontinue start. ITT above 870° C shall be monitored during start and if time exceeds limits shown in figure 5-2, a hot start has occurred.

**WARNING**

The fuel quantity, fuel flow and low fuel warning indicators are not precise and should not be relied upon for an indication of a safe fuel reserve. The fuel quantity indicator may be in error by as much as 30 lbs.

e. Primary Communications Radio - ON

f. Check generator voltage 27-28.5

13. Fire Guard - POSTED.

14. Second Engine - START.

a. Starter - ENGAGE

b. Engine Oil Pressure - Indicating.

c. Throttle - At 12% Ng minimum, open to ground idle.

d. ITT - Monitor.

e. Starter - OFF at 50% Ng.

**CAUTION**

Ensure that the second engine has engaged. A non-engaged engine is indicated by near zero torque, high Nf, and much cooler ITT compared to the engaged engine. If a non-engagement occurs, slowly close the throttle of the non-engaged engine to OFF. When the non-engaged engine has stopped, shut down the engaged engine. If an abrupt Nf deceleration, jolt, or noise occurs during shutdown, enter the discrepancy in AF Form 781 and do not attempt another start. If shutdown is normal, a restart may be attempted by starting the engine that failed to engage, first, and a normal engagement should result.

15. Engine Oil Pressure - WITHIN LIMITS.

16. Throttle Sequence - COMPLETED.

16A. Battery — CHECKED ON.

17. External power - DISCONNECTED.

18. Generators - ON.

19. DC Electrical systems - CHECKED (First flight of the day).

a. No. 1 generator - Off. Check No. 2 generator voltage 27-28.5 and No. 2 ammeter increased load. Check No. 1 generator voltage and ammeter indications zero, and caution light illuminated. Check Non Essential bus voltage 27-28.5.

b. Non-Essential Bus Switch - Normal. Check voltage indicates zero, then return the switch to MANUAL position.

c. No. 1 generator - On. Observe engine No. 1 DC generator caution light extinguishes and ammeters indicate load sharing.

SEE SUPP 1594

d. No. 2 generator - Off. Check No. 2 generator voltage and ammeter indications zero, and caution light illuminated. Check generator No. 1 voltage 27-28.5 and No. 1 ammeter increased load. Check Non-Essential bus voltage 27-28.5.

e. Non-Essential Bus Switch - Normal. Check voltage indicates zero.

f. No. 2 generator - On. Observe engine No. 2 DC generator caution light extinguishes, ammeters indicate load sharing, and Non-Essential bus voltage 27-28.5.

g. Voltmeter Selector Switch - ESS Bus

20. Non-essential Bus Switch - As Required. During night and hoist operations, the non-essential bus switch should be in the manual position to preclude loss of electrical power to the search light and hoist controls due to generator(s) failure.

ENGINE RUN UP.

1. No. 1 Throttle - FULL OPEN. Slowly advance to full open. Check Nf approximately 95%.

2. Beep Switch - MAXIMUM. Slowly increase through full range (Nf should increase 4.5 ±0.5%).

3. No. 2 Throttle - FULL OPEN. Slowly advance to full open. Check Nf for a minimum increase of 2%.

**WARNING**

Sufficient throttle friction must be applied to each throttle to prevent inadvertent throttle interaction.

4. Beep Switch - 100% Nf.

5. Hydraulic System - CHECKED. Not required after first flight of the day.

**WARNING**

Insure area is clear of personnel and equipment prior to checking flight controls.

a. HYDR CONTROL MASTER Switch - ON.

b. Select System 1; check cyclic, collective and rudder pedals using small amplitude inputs to verify System 1 is satisfactory.

c. Select System 2; check cyclic and collective using small amplitude inputs to verify System 2 is satisfactory. Apply force to pedals to verify that tail rotor pitch change can be made "boost off."

d. Return selector switch to BOTH.

6. Flight Controls - CHECKED. Adjust friction and check for proper response.

**NOTE**

Chattering will occur in the cyclic and/or collective controls when the control is moved at a rate greater than full travel in one second. High frequency vibration or chattering of small amplitudes can be expected to occur in the tail rotor controls during normal operation.

7. Auxiliary fuel transfer pump switch - AFT or FWD (if auxiliary fuel tanks installed), OFF (if auxiliary fuel tanks not installed).

**CAUTION**

Failure of auxiliary fuel low warning light to illuminate when auxiliary fuel transfer pump switch is turned on (AFT position) indicates usable fuel in the auxiliary fuel tank. If operation with fuel in auxiliary fuel tanks was not planned it is essential to determine auxiliary fuel on board. Return auxiliary fuel transfer pump switch to OFF – and place the unselected auxiliary fuel transfer pump switch to AFT. If auxiliary fuel low warning light does not illuminate, fuel level must be determined by another method (Usually the wet check method using a locally fabricated dip stick).

**NOTE**

Weight and balance computations are based on fuel being used from the auxiliary fuel tanks.

The automatic auxiliary fuel transfer sequence should be initiated as soon as possible unless weight and balance has been computed to allow for other than normal fuel transfer. This precludes unprogrammed shift of C.G. Normally the left auxiliary fuel transfer pump switch will be selected on odd days and the right auxiliary fuel transfer pump switch selected on even days.

Approximately five gallons of usable fuel will remain in the unselected aft auxiliary fuel tank after illumination of the auxiliary fuel low

warning light if this method of operation is used. To transfer the remaining five gallons of fuel, the selected auxiliary fuel transfer pump switch must be positioned to OFF and the unselected auxiliary fuel transfer pump switch placed in the AFT position. Upon re-illumination of the auxiliary fuel low warning light, place the fuel transfer switch to OFF. This ensures that all usable fuel in the auxiliary fuel tanks reaches the main fuel tank and that each auxiliary fuel transfer pump is operating properly. The above procedure assumes that both aft auxiliary fuel tanks and interconnect line are installed.

**NOTE**

In the event that the main fuel system upper float switch fails to cycle off, overboard fuel flow is imminent. The pilot or other designated crew member will periodically monitor fuel quantity cycling while the transfer system is in operation.

## BEFORE TAKE OFF

1. Ground Leak and Hydraulic Filter Indicator Check – COMPLETED.
2. Com/Nav Radios – AS REQUIRED.
3. IFF/SIF – STANDBY.
4. Radar Altimeter – ON.
5. Pedestal Cooling Control – AS REQUIRED.

**CAUTION**

Pedestal cooling valve must be shut off (IN) if heater is ON.

SEE SUPP 15-94

6. Heater Switches – AS REQUIRED.

* PILOT HEAT

7. Pitot Heat – AS REQUIRED. Check for proper operation by placing pitot switch to an ON position and noting an increase or jump on the DC ammeter.
8. RPM (Nf) – 100%.
9. Engine and Transmission Instruments – CHECKED.
10. Flight and Navigation Instruments – CHECKED.
    a. Airspeed Indicator – Check.
    b. Heading Indicator. Check heading indicator for indication.
    c. Attitude Indicator – Check.
    d. Turn and Slip Indicator – Check.
    e. Vertical Velocity Indicator – Check for zero setting.
    f. Magnetic Compass – Check heading indication, card swinging freely, and that bowl is full of fluid.
    g. Navigation Equipment – Check.
11. Doors – CHECKED.
    a. Cockpit Doors – Locked.
    b. Cabin Doors – As desired.
12. Shoulder Harness Lock – AS DESIRED.
13. Altimeter and Clock – CHECKED.

**NOTE**

The field barometric pressure (altimeter setting) should be within .075 of the previously established setting. Due to difference of pressure caused by rotor downwash, the altimeter will show a decrease of approximately 20 feet after engine start. This temporary altimeter error should be considered when determining tolerance limits. Do not reset the altimeter for this decrease.

14. Force Trim – AS DESIRED.

**WARNING**

Physically monitor the tail rotor pedals and cyclic stick anytime the rotors are turning and the force trim system is off or the force trim button is actuated.

15. IFF/SIF – AS REQUIRED.
16. Crew, Passengers, and Cargo Compartment – PREPARED FOR TAKEOFF.
17. Landing, Searchlight Navigation, Anti-Collision/Strobe Lights – AS REQUIRED.
18. Area – CLEAR.

### BEFORE TAKE-OFF (MULTIPLE TAKE-OFFS/ LANDINGS)

1. Engine and transmission Instruments — NORMAL.

2. Crew, Passengers, and Cargo Compartment PREPARED FOR TAKEOFF.

3. Area — CLEAR.

## TAKE-OFF

Hover Check — COMPLETED. After established in hover, check hover power, engine, flight and transmission instrument and proper C.G. conditions.

## TYPES OF TAKE-OFF

Factors which will determine the type of take-off to be performed are: gross weight of the helicopter, meteorological conditions, characteristics and obstacles associated with the take-off area, and the tactical situation. There are many possible take-off variations, but they all fall within two categories — normal or maximum performance. A normal take-off is one that utilizes the recommended height and airspeed combinations as depicted in the H-V Charts in Appendix 1. A maximum performance take-off is one that places the helicopter outside the recommended height and airspeed combination (minimum distance take-off), or requires a ground slide to obtain translational lift. Take-offs are normally initiated from a hover but may be made from the ground. This take-off technique is used to expedite departure or when hovering is undesirable such as a take-off from sand or snow. All take-offs should be accomplished with 100 percent Nf.

**CAUTION**

Minimum single engine airspeed should be attained as soon as practical after take-off.

### TAKE-OFF TO A HOVER

The take-off to a hover is accomplished by increasing collective pitch to establish the desired hover altitude. This altitude should be a maximum of 5 feet between the skids and the ground. Maintain the desired heading with the tail rotor pedals and the aircraft position with the cyclic control.

#### Level-Acceleration Take-Off

The level acceleration take-off may be required when operating from small and/or restricted areas when sufficient power to hover out-of-ground effect is not available. From a hover accelerate to the recommended climb-out airspeed, reference Appendix I. As the airspeed is approached, establish a climb by applying full power and smoothly applying aft cyclic to maintain the climb airspeed. After the desired height has been reached, smoothly increase airspeed transitioning to a normal climb.

**WARNING**

- During climb-out at the speed listed in Appendix I, do not inadvertently allow the airspeed to drop below translational lift speed. Critical settling to the ground may occur.
- Level Acceleration from a Two Foot Skid Height Single Engine, information is included in Appendix I, but this type takeoff should only be attempted in a combat emergency situation.

#### Climb and Acceleration Takeoff

The climb and acceleration takeoff may be required when operating from small and/or restricted areas when sufficient power to hover out-of-ground effect is available. From a hover, apply forward cyclic pressure and at the same time apply full available power. The forward speed and rate-of-climb (climb angle) may be varied to achieve the desired performance listed in Appendix I. When sufficient altitude for obstacle clearance has been reached, smoothly transition to a normal climb. Vertical takeoffs and climb out-of-ground effect altitude are not recommended; however, if operational necessity requires a vertical takeoff, accelerate to minimum climb airspeed as soon as possible after clearing obstacles. If a vertical takeoff is required, employ the normal takeoff to hover procedures until the desired altitude is attained.

**NOTE**

When more than sufficient power is available to accomplish the takeoff, the pilot may elect to choose a power setting less than maximum available.

#### Slide Take-Off

When sufficient power to accomplish a normal takeoff is not available, it may be possible to perform a takeoff without hovering by sliding the helicopter on the ground. Accomplish by heading the helicopter into the wind if practical. Increase collective pitch and apply cyclic control as necessary to obtain takeoff speed. The helicopter will normally fly off the surface as translational lift is obtained. Some aft cyclic may be necessary to prevent an excessively nose low attitude. Continue acceleration to climb airspeed. Maintain directional control with tail rotor pedals throughout the maneuver. To practice this takeoff, use approximately five per cent torque less than required to hover at three feet skid clearance.

**WARNING**

If the helicopter cannot be stabilized at a 2-foot hover without RPM bleed-off it is overloaded. Cargo and/or passengers should be off loaded to the extent that no RPM bleed-off is required. If the wind is at or above translational lift the operational value of the slide takeoff has been practically eliminated.

**CAUTION**

The helicopter may have a tendency to leave the ground in a slightly nose down attitude. Care should be exercised to avoid striking the skids on the ground.

### CROSSWIND TAKE-OFF

In the event a crosswind take-off is required, normal take-off procedures are used. As the helicopter leaves the ground there will be a definite tendency to drift downwind. When a crosswind take-off is accomplished, it is advisable to turn the helicopter into the wind for climb as soon as obstacles are cleared and terrain permits.

## ROLLOVER CHARACTERISTICS

During normal takeoffs and landings, with the aircraft light on the gear, bank angle, sidedrift or cross-winds may cause the helicopter to begin pivoting or rolling laterally. Under these conditions, lateral cyclic stick inputs are less effective in generating a rate of roll than for a free hovering helicopter. If bank angle and roll rate are allowed to increase, a critical combination of rate and angle will be reached where lateral cyclic inputs do not stop the rolling tendency. Full lateral cyclic will be insufficient to keep the helicopter from rolling over. Without proper corrective action, bank angles of as little as 5 degrees, coupled with roll rate and cross-winds can cause the aircraft to roll over in approximately 2 seconds.

**WARNING**

When performing normal landing and takeoffs the pilot must maintain precise control of roll attitudes so as not to allow the aircraft to reach a critical bank angle and roll rate that cannot be controlled with lateral cyclic. If a rolling tendency commences, corrective action must be taken immediately. Depending on the situation, either raise collective and lift off or reduce collective to stop the rolling tendency. Reduction of collective is most effective in controlling rolling motions and is the recommended procedure if conditions permit. Raising collective and lifting off is acceptable but be prepared for an abrupt roll in the opposite direction.

## CLIMB

Maintain climb airspeed and monitor instruments. Refer to the climb data in Appendix 1 for climb performance. Optimum climb airspeed is 50 KIAS. However, when optimum performance is not required, recommended climb airspeed is 70–80 KIAS. Climbs during cruise flight may be conducted at cruise airspeed.

## FLIGHT CHARACTERISTICS

(Refer to Section VI.)

## BEFORE LANDING

1. Crew and Passengers – BRIEFED. Advise occupants as required.

2. Engine rpm – 100% Nf.

## APPROACHES

The following approaches and landings are basic maneuvers. It may be necessary to modify or combine elements of each to obtain the desired results during operational conditions. If operational conditions dictate (blowing sand, snow, and possibilities of foreign object damage), any approach may be made to a touchdown and terminated at zero forward speed without hover. Maintain Nf 100%. Loss of airspeed during descent can result in settling with power. Engine acceleration should be anticipated so as to provide sufficient power to control rate of descent.

**CAUTION**

- Care should be exercised to avoid an extreme tail low attitude near the ground to preclude tail rotor contact. At 12 degree nose up attitude, the tail rotor skid and the rear of the skids will contact the ground simultaneously. It is suspected that the tail rotor guard has contacted the ground, a visual inspection shall be accomplished immediately, by the pilot or crew chief (if available), to determine if the warning or protective capability of the tail rotor guard has been impaired. Further flight should be discontinued or restricted (depending on the damage involved) until corrective action is taken. All landings involving contact of the tail rotor guard with the ground will be noted in the aircraft forms.
- Helicopter operation over areas of blowing grass, leaves, etc. may cause foreign matter accumulation on the engine inlet air filter. The accompanying restriction in air flow can reduce engine performance and cause possible compressor stall.
- When operating in the vicinity of any loose objects (i.e., signal panels, parachutes, debris), use extreme caution to preclude objects being blown up into the aircraft rotor systems.

### NORMAL APPROACH

The object of a normal approach is to bring the helicopter to a hover over the spot of intended landing when obstacles do not interfere with the approach angle. Entry airspeed is normally 70 KIAS, with an apparent approach angle of 30 degrees. Progressively decrease the rate of descent and groundspeed so as to enter a hover over the intended landing spot. As forward speed is reduced additional power will be required to compensate for the decrease in translational lift and to maintain the desired angle (figure 2-2).

**CAUTION**

At 12 degree nose up attitude, the tail rotor guard and the rear of the skids will contact the ground simultaneously.

### STEEP APPROACH

The steep approach is used to clear obstacles and to land in confined areas. Wind effect must be considered when establishing the desired entry airspeed. The entry airspeed should be adjusted to provide approximately 30 knot groundspeed with an apparent approach angle of 45 degrees. The approach is initiated and flown the same as the normal approach. Some forward speed should be maintained at all times and the rate of descent should not exceed 800 fpm.

**WARNING**

Reducing forward airspeed to zero before reaching hover altitude may result in settling with power. If the landing spot has been overshot, execute a go-around immediately.

### SHALLOW APPROACH/SLIDE LANDING

The shallow approach is the same as the normal approach except that an apparent ten degree approach angle should be maintained. Land from a hover or accomplish slide landing by maintaining airspeed above translational lift (approximately 15 to 20 KIAS) allowing the helicopter to touchdown. After contact, slowly lower collective pitch to allow skid friction to slow forward groundspeed.

**CAUTION**

An abrupt reduction of collective pitch upon ground contact may cause the helicopter to nose over and a possibility of the rotor contacting the fuselage or tail.

### APPROACH TO TOUCHDOWN WITHOUT HOVER

See Section IX. If operational conditions dictate (blowing sand, snow, and possibilities of foreign object damage), any approach to a touchdown may be made at zero forward speed without hover.

1. Accomplish before landing check.

   Airspeed - 50 knots minimum.

   Engine - 100% Nf.

2. Start approach. Adjust collective pitch control friction - As desired.
3. Maintain desired approach speed.
4. Gradually apply rearward cyclic control stick to decrease airspeed.
5. Increase collective pitch sufficiently to establish hovering flight a few feet above ground.
6. Accomplish landing.

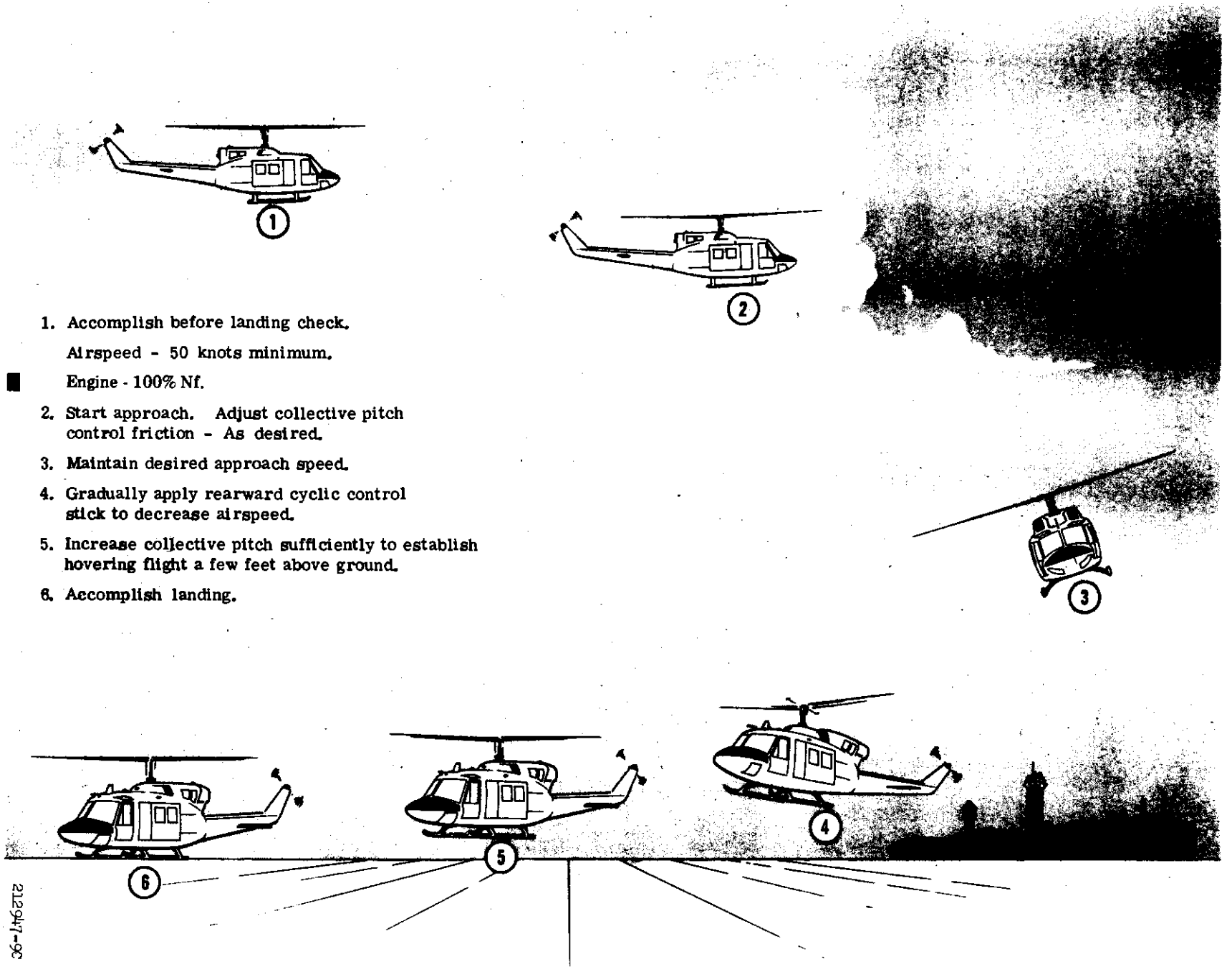



Figure 2-2. Normal approach and landing -- power on -- typical

**CAUTION**

Helicopter operation over areas of blowing grass, leaves, etc., may cause foreign matter accumulation on the Engine Inlet Screens. The accompanying restriction in air flow can reduce engine performance and cause possible compressor stall. Whenever clogging of the Engine Air Inlet Screens is suspected a visual inspection should be made prior to the next flight.

## LANDING

### NORMAL LANDING

From a hover, decrease collective pitch to effect a constant, smooth rate of descent until touch-down, making necessary corrections with pedals and cyclic control to maintain level attitude and constant heading and to prevent movement over the ground. Upon contact with ground, continue to decrease collective pitch smoothly and steadily until the entire weight of the helicopter is resting on the ground.

### SLOPE LANDINGS

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 the downslope skid touches the ground. Continue coordinating reduction of collective pitch and application of cyclic into the slope until all the weight of the aircraft is resting firmly on the slope. If the cyclic control contacts the stop before the downslope skid is resting firmly on the ground, return to hover and select a position where the degree of slope is not so great. After completion of a slope landing, slowly lower collective and neutralize cyclic and determine that the aircraft will maintain its position.

**WARNING**

Slope landing data for all conditions is not available. Extreme caution must be used when landing on any slope.

**CAUTION**

Aircraft shutdown and subsequent loss of lift may result in aircraft sliding downslope.

### CROSSWIND LANDINGS

Crosswind landings will be made in the same manner as normal landings using cyclic stick and pedals to prevent side drift.

## AFTER LANDING

**WARNING**

Under certain conditions, the rotating main rotor blades may flex or droop, resulting in a low ground clearance (as low as 5 feet), which may be hazardous to boarding or deplaning personnel. If possible, the main rotor Flight Idle RPM should be maintained until all boarding or deplaning personnel are clear clear of the rotor disc area. If this is not possible, the pilot will inform all boarding or deplaning personnel to keep their heads well down below the plane of rotation of the rotor arc. The pilot should not deplane until the rotor blades have stopped rotating.

1. Throttles - FLIGHT IDLE.

**NOTE**

Maintain flight idle one minute prior to closing throttles to stabilize engine temperatures.

2. Force Trim - ON.
3. Non-Essential Com/Nav Radios - OFF (except KY28).
4. Loudhailer Switch - OFF.
5. IFF/SIF- OFF.
6. Radar Altimeter - OFF.

## ENGINE SHUT-DOWN

1. Flight Idle Stop Switch - ACTUATE.

2. Both Throttles - OFF. Observe any changes in normal gas generator coast down time, which should not be less than 20 seconds from flight idle, and listen for any unusual noises such as scraping, rubbing or grinding.

**NOTE**

One-third collective control may be used to slow the rotor. Reduce collective to minimum before the rotor hits the stop or prior to rotor brake application.

3. Main Fuel Switches - OFF.

IS-101
* SUPP ~~105-99~~ +106 -97
ONLY AT 0% NR

4. Generators - OFF.
5. Rotor Brake - Apply ~~at or below 40% NR.~~

**NOTE**

During shutdown note that the engines decelerate freely.

## BEFORE LEAVING HELICOPTER

1. Inverter — OFF.
2. Navigation/Anti-Collision Lights — OFF.
3. All Radios — OFF (except KY 28).
4. Other Switches — AS DESIRED.
5. Form 781 — COMPLETE.

**NOTE**

The flight crew will make entries in the AFTO Form 781 to indicate when any limits have been exceeded including the maximum limit reached and the time duration.

## HOT REFUELING PROCEDURES (ENGINE RUNNING)

These procedures will only be used in an emergency or as mission requirements dictate and authorized by the MAJCOM, after a System Safety Engineering Analysis in accordance with T.O. 00-25-172S-11 has been accomplished.

**CAUTION**

The flight/helicopter mechanic will insure that the refueling equipment and the type fuel to be used is compatable with the aircraft fuel system prior to commencing refueling operations.

1. Collective Pitch - "FLAT PITCH" (P)
2. Throttles - "AS REQUIRED" (P)
3. Crossfeed - "OFF" (P)
4. Non-Essential Com/Nav Equipment - "OFF" (P). Turn off the IFF/SIF, Radar Altimeter, Loudhailer, and all com/nav radios except for the primary communication radio.

**WARNING**

DO NOT turn electrical or avionics equipment ON or OFF during refueling. Transmissions on the primary com radio will be restricted to emergency use only.

5. Door/Windows - "AS REQUIRED" (P), (CP), (FM). Doors and windows on the same side as the refueling operation will be closed. Doors on the opposite side should be open to permit a rapid egress of the crew in the event of an emergency.
6. Refueling Unit - "POSITIONED" (FM)
7. Ground Static Wires - "ATTACHED" (FM)
8. Fire Guard - "POSTED" (FM)
9. Protective Cap - "REMOVED" (FM)
10. Refueling Nozzle - "CONNECTED" (FM)
11. "CLEARED TO REFUEL" (P)
12. Fuel Flow - "ESTABLISHED" (FM)

**NOTE**

The pilot/co-pilot will monitor the fuel quantity guage to insure adequate refueling.

13. Fuel Flow - "STOPPED" (FM)

**NOTE**

If less than a full fuel load is required, the pilot will direct the FM to cease refueling when the desired quantity is obtained.

14. Refueling Nozzle - "DISCONNECTED" (FM)
15. Protective Cap - "INSTALLED" (FM)

**NOTE**

If the auxiliary fuel tanks are to be refueled, repeat steps 7 thru 17.

16. Ground Static Wires - "REMOVED" (FM)
17. Proceed and accomplish the BEFORE TAKE-OFF checklist.

## ALERT PROCEDURES

To place the helicopter in an alert or cocked posture and to launch in the shortest possible time consistent with safety, accomplish the Acceptance, Cocking and Scramble procedures.

## ACCEPTANCE

Complete the following checks;

1. Before Exterior Inspection.
2. Exterior Inspection.
3. Interior and Before Start.

**NOTE**

For external cargo load mission, all electrical and manual releases must be checked operational.

4. Starting Engines.
5. Engine Run-up.
6. Before Takeoff.
7. After Landing.
8. Engine Shut-Down.
9. Before Leaving the Helicopter.

## COCKING

The following checks must be completed to establish a cocked (scramble) status:

1. External Power Unit - POSITIONED and CONNECTED (if applicable)
2. Rotor Brake - OFF
3. Main Fuel Switches - ON
4. Essential Radios - AS REQUIRED
5. IFF/SIF - AS REQUIRED
6. Anti-collision Light — AS REQUIRED
7. Navigation Light — AS REQUIRED
8. Inverter Switch — MAIN (OFF if battery start is to be made).

**SCRAMBLE** (Cocked Aircraft)

1. All Covers, Tiedowns, and Ground Wires — REMOVED.

1A. Safety Belt, Shoulder Harness, Seat and Rotor Pedals — FASTENED and CHECKED.

2. Ignition Keylock Switch - ON. Switch will remain ON for duration of flight.

3. External Power - ON.

3A. Battery switch - PN (If external power is not utilized, Battery Switch - START).

4. Engine - START.

a. Starter - ENGAGE.

b. Engine Oil Pressure - Indicating.

c. Throttle - At 12% Ng Minimum, open to ground idle.

**CAUTION**

If ITT fails to rise within 15 seconds after opening the throttle, close the throttle and turn Main Fuel Switch and Starter OFF. Allow a 30-second fuel draining period, followed by a 15-second motoring run before attempting another start. If, for any reason, a starting attempt is discontinued, allow the engine to come to a complete stop and then accomplish a motoring run. Repeat the complete starting sequence, observing the starter limits.

d. ITT - Monitor.

**CAUTION**

If ITT exceeds 1090° C, move the throttle to OFF position and discontinue start. ITT above 870° C shall be monitored during start and if time exceeds limits shown in figure 5-2, a hot start has occurred.

e. Starter - OFF at 50% Ng.

**CAUTION**

It is possible to move the starter switch through the OFF position and inadvertently engage the other starter.

5. Inverter Switch - MAIN (if battery start was made).

6. Combining Gearbox Oil Pressure - INDICATING.

7. Transmission Oil Pressure - INDICATING.

8. Engine Oil Pressure - WITHIN LIMITS.

9. Throttle Sequence - COMPLETED.

a. Engine Ng - Stabilized.

b. Flight idle Stop Switch - Actuate.

c. Throttle - Open to approximately 85% Ng.

**NOTE**

Allow approximately five seconds for flight idle plunger actuation.

d. Throttle - Flight Idle (61 ± 2%)

e. Throttle - 71% Ng.

f. Throttle Friction - Set.

10. Generator - ON (if battery start was made turn operating engine generator ON and accomplish the following):

a. Battery Switch — ON.

b. Anti-collision Light — AS REQUIRED.

c. Navigation Lights — AS REQUIRED.

d. IFF/SIF — AS REQUIRED.

e. Essential Radios — ON.

f. Check generator voltage 27-28.5.

11. Second Engine - START.

a. Starter - ENGAGE.

b. Engine Oil Pressure - Indicating.

c. Throttle - At 12% Ng minimum, open to ground idle.

d. ITT - Monitor.

e. Starter - OFF at 50% Ng.

**CAUTION**

Ensure that the second engine has engaged. A non-engaged engine is indicated by near zero torque, higher Nf, and much cooler ITT compared to the engaged engine. If a nonengagement occurs, actuate the Flight Idle Stop Switch and slowly close the throttle of the non-engaged engine to OFF. When the non-engaged engine has stopped, shut down the engaged engine. If an abrupt Nf deceleration, jolt, or noise occurs during shutdown, enter the discrepancy in AF Form 781 and do not attempt another start. If shutdown is normal, a restart may be attempted by starting the engine that failed to engage first, and a normal engagement should result.

12. Engine Oil Pressure - WITHIN LIMITS.

13. Throttle Sequence - COMPLETED.

14. External power - DISCONNECTED. Check Battery and Generators ON.

15. Non-essential Bus Switch - AS REQUIRED. During night and hoist operations, the non-essential bus switch should be in the manual position to preclude loss of electrical power to the search light and hoist controls due to generator(s) failure.

16. Throttles — FULL OPEN.

17. Beep Switch — 100%Nf.

18. Auxiliary Fuel Transfer Pump Switch — AFT or FWD (if auxiliary fuel tanks installed), OFF (if auxiliary tanks not installed).

19. COMM/NAV — AS REQUIRED.

19A. IFF/SIF — AS REQUIRED.

20. Instruments — CHECKED.

21. Doors — SECURED.

22. Crew, Passengers, and Cargo Compartment — PREPARED FOR TAKE-OFF.

23. Area — CLEAR.

24. Hover Check — COMPLETED.

## COCKED AIRCRAFT SECURITY

Access to a "cocked" aircraft should be restricted to the assigned aircrew only. However, if maintenance is performed that requires electrical power, the aircraft must be "uncocked" utilizing the uncocking procedures. Upon completion of said maintenance, "recock" the aircraft by completing the Acceptance check (steps 3 thru 7 only) and Cocking Procedures. Unless the maintenance performed affected the engine(s) and/or related system, engine starting and running checks may be omitted.

## UNCOCKING

Complete the ENGINE SHUT-DOWN AND BEFORE LEAVING THE HELICOPTER checks.

**PASSENGER INFORMATION**

1. Safety belts will be securely fastened at all times.

2. Smoking is prohibited during ground operation, take-offs, landings, and when directed by the pilot. Operation of butane and/or plastic reservoir lighters is prohibited.

3. Operation of portable electronic equipment is prohibited.

4. If it becomes necessary to evacuate the helicopter, see other side of card.

5. If a crash landing becomes necessary, proceed as follows:

a. Open emergency exits as directed by the pilot.

b. Loosen tie.

c. Tighten safety belt.

d. Prior to contact with the surface, passengers will bend forward at the waist with their feet firmly on the floor and chest resting on the knees. Arms will be wrapped around and behind the thighs and clasped with the hands. The head/face will be placed into/between the knees.

6. Alarm Signals:

a. Crash landing or ditching.

(1) 6 short - prepare for crash landing.

(2) 1 long - just prior to impact.

b. Bail out.

(1) 3 short - prepare to bail out.

(2) 1 long - bail out.

**Figure 2-3. Passenger information (Sheet 1 of 2)**

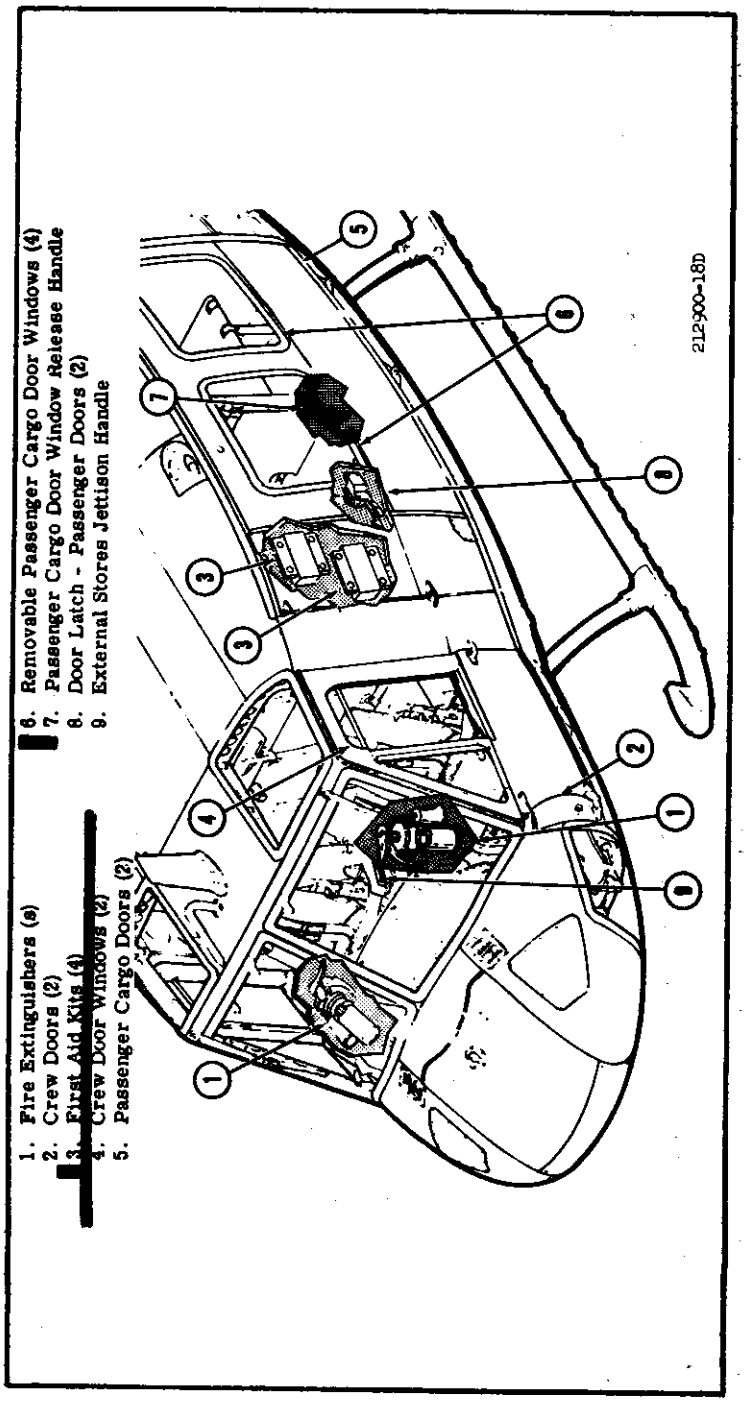
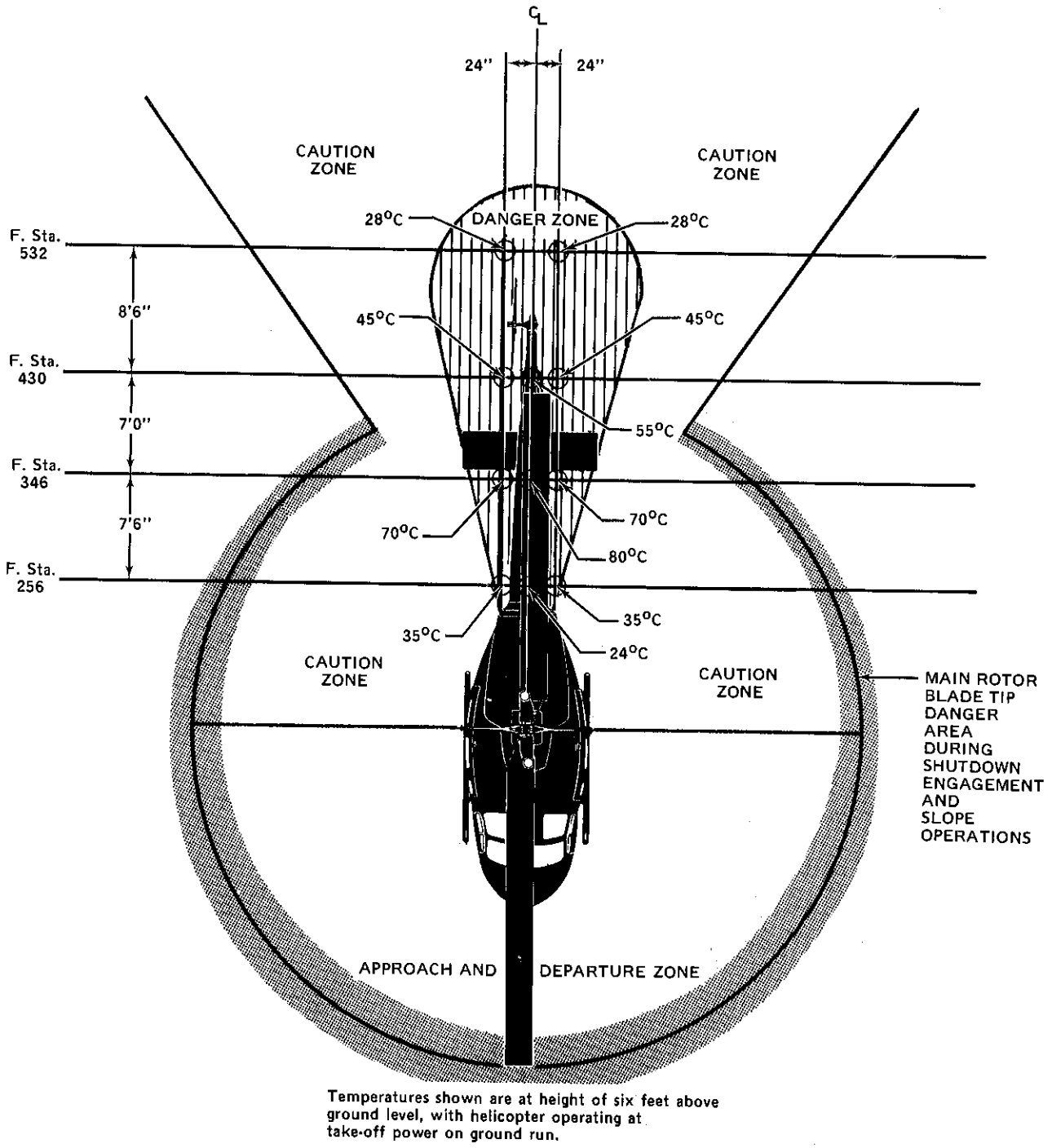



Figure 2-3. Passenger information (Sheet 2 of 2)




Temperatures shown are at height of six feet above ground level, with helicopter operating at take-off power on ground run.

212900-77A

**Figure 2-4. Approach, departure and danger zones**

# SECTION III

# EMERGENCY PROCEDURES

## TABLE OF CONTENTS



## EMERGENCY PROCEDURES

Emergency procedures are divided into two categories, critical and non-critical. The critical items are those which must be performed immediately if the emergency is not to be aggravated. These critical items are identified by the use of bold face type, and must be memorized and performed in proper sequence without direct reference to the checklist.

Noncritical emergency procedure actions are those that contribute to an orderly sequence of events and assure that all necessary actions are taken. These procedures are accomplished with direct reference to the checklist.

The nature and severity of the emergency will dictate the degree of compliance necessary; therefore, aircrews must use sound judgment to determine the correct action to be taken.

The following basic rules apply to all aircraft emergencies and should be thoroughly understood by all aircrews:

1. MAINTAIN AIRCRAFT CONTROL.

2. ANALYZE THE SITUATION AND TAKE PROPER ACTION.

3. LAND AS SOON AS PRACTICAL.

As soon as possible, the pilot should inform all other crewmembers and reporting agencies of the nature of the emergency and the intended course of action taken and/or to be taken.

## EMERGENCY PROCEDURE ACTIONS.

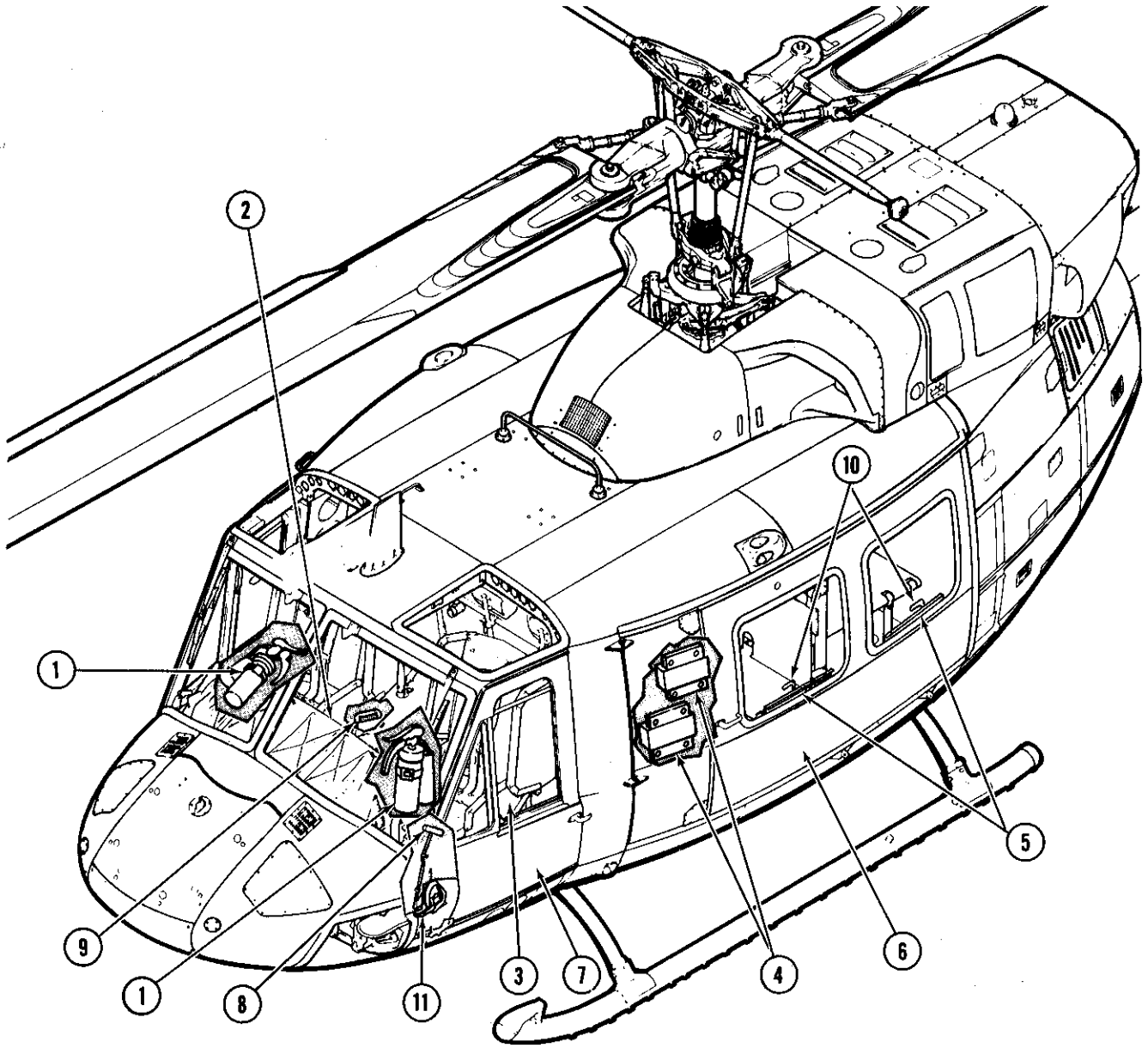
The following Emergency Procedure actions are provided as recommendations to the pilot to be modified depending upon the nature and severity of the emergency, compounding emergencies, and the environment in which the pilot is flying the aircraft.

## LAND AS SOON AS POSSIBLE.

The nature and environment of the emergency dictates that a landing be made at the first available area which will assure minimum injury to crew or minimum damage to the aircraft; i.e., transmission oil starvation.

## LAND AS SOON AS PRACTICAL.

The nature and environment of the emergency dictates that a landing be made at the first available area or landing site which will assure no injury to the crew or damage to the aircraft and provides acceptable access for corrective action; i.e. single hydraulic system failure.




1. Fire Extinguishers (2)
2. Fire Detection System Indicators
3. Crew Door Windows (2)
4. First Aid Kits (4)
5. Removable Passenger Cargo Door Windows (4)
6. Passenger Cargo Doors (2)
7. Jettisonable Crew Doors (2)
8. Internal Jettisonable Door Release - Crew Doors (2)
9. External Stores Jettison Handle
10. Cargo Door Window Release Handles
11. External Emergency Release Handle (2)

**Figure 3-1. Emergency exits and equipment**

## GROUND OPERATIONS

### ENGINE FIRE ON GROUND

If the presence of fire is suspected because of illumination of fire warning system, erratic instrument reading, or detected visually by fire guard, proceed as follows:

**1. THROTTLES - OFF**

**2. FIRE PULL HANDLE - PULL (affected engine)**

3. Fire Extinguisher Selector Switch - Select MAIN and/or RESERVE

**WARNING**

Activation of the engine fire extinguisher with engine cowling open will cause the extinguishing agent to be ineffective and could be hazardous to ground crew personnel.

4. Complete Engine Shutdown

## ENGINE FAILURE

Failure of both engines requires immediate action if a safe power-off landing is to be accomplished. The altitude and airspeed at which engine failure occurs will dictate the action to be taken to effect a safe landing. The airspeed and altitude combinations at which there is no adequate procedure for effecting a safe power-off (dual failure) landing are reflected in figure A-12. The majority of turbine engine flame-outs are the result of improper fuel flow caused by fuel control system malfunction. It should be noted that the engine instruments often provide indications of fuel control system failure prior to actual engine failure. In the event of apparent mechanical failure within either engine, air starts should not be attempted.

**CAUTION**

During cruise the automatic fuel control could fail without recognition unless either a higher power setting is used or a single engine failure should occur. Therefore, if during a single engine failure the remaining engine does not produce adequate power or during high power settings when one engine indicates power loss, the problem may be in the automatic fuel control. The pilot should immediately shift to manual fuel control.

**NOTE**

When one engine fails, the remaining engine will automatically increase to the power required for continued flight, if sufficient power is available, or go to maximum power available.

## FLIGHT CHARACTERISTICS UNDER SINGLE ENGINE CONDITIONS

The altitude, airspeed, and gross weight at which an engine failure occurs will dictate the action to be followed to effect a safe landing. Level flight can be maintained at low altitude and normal gross weight with standard day conditions, except when hovering or operating at low airspeed. As altitude increases above sea level, maximum gross weight at which level flight can be maintained, decreases.

### SINGLE ENGINE FAILURE WHILE HOVERING AT LOW ALTITUDE (0 TO 20 FEET).

When hovering at low altitudes (0 to 20 feet) in ground effect, maintain a level attitude and eliminate drift, using cyclic control and tail rotor pedals. At these altitudes, if power available is not adequate to prevent touchdown, the collective control should be held fixed or increased as required (to maximum if necessary) to cushion the landing. Beeping to maximum may increase available rotor rpm which increases lift available to cushion landing. After landing shut the aircraft down.

### SINGLE ENGINE FAILURE WHILE HOVERING AND DURING TAKE-OFF (ALTITUDE ABOVE 20 FEET)

The altitude and airspeed at which an engine failure occurs will dictate the action necessary to effect a safe landing. Power requirements and helicopter control must be closely monitored. While in a hover or with high power settings, it may be necessary to reduce the collective pitch to maintain desired rotor speed. If altitude permits, lowering the nose to attain airspeed will provide energy for flaring or may permit translation into forward flight. If committed to land, flare the aircraft to increase rotor speed and reduce touchdown speed. On take-off, if flight can be continued utilize SINGLE ENGINE FAILURE DURING FLIGHT procedure. If not able to continue flight, a moderate flare may be used to slow the aircraft and increase rotor speed. Touchdown should be made in a level attitude without drift and reduce forward speed as conditions permit.

### SINGLE ENGINE FAILURE DURING FLIGHT

The ability to maintain level flight after one engine fails will be governed by the following conditions: gross weight, airspeed, and density altitude. The above conditions may demand more power from the operating engine than that which is available and consequently single-engine flight cannot be maintained. However, descending to a lower altitude, if terrain clearance will allow, and selecting the airspeed for minimum power required may allow single-engine flight to be continued. Climb to minimum safe autorotation altitude should be considered if power is available. Should conditions preclude maintaining a safe altitude on one engine, land as soon as possible. If one engine fails, all helicopter systems will function normally since the systems are independent of the engines except the heater and non-essential bus equipment. Power can be restored to the non-essential bus by placing the non-essential bus switch to the manual position. Refer to Appendix I for single-engine performance data. The following procedures should be accomplished when one engine fails during flight:

**NOTE**

When one engine fails, rotor speed can be expected to drop as much as 2% rpm or more. This can normally be regained, if sufficient power is available, by increasing the beep switch to maximum. At high airspeed, altitude, or heavy gross weight, a momentarily reduction of collective pitch may also be required to aid in regaining rotor rpm. It is possible for the remaining engine not to have sufficient power to regain lost rotor rpm and maintain altitude at the same time.

1. **NR – MAINTAIN WITH COLLECTIVE.**
2. **BEEP SWITCH – MAXIMUM.**
3. **AIRSPEED – 55 KIAS MINIMUM.**
4. Engine – SHUTDOWN. Refer to ENGINE SHUTDOWN IN FLIGHT.
5. Presence of Fire – CHECK. If fire exists or the ITT does not decrease normally, complete the procedures for ENGINE FIRE.

**NOTE**

After the engine cleanup procedures have been performed, investigate and determine if the engine can be safely restarted; if so refer to ENGINE RESTART DURING FLIGHT.

### ENGINE FAILURE WITH EXTERNAL STORES OR LOAD

Single Engine Failure. External stores should be jettisoned if required to maintain level flight, or to prevent an additional hazard upon landing.

Dual Engine Failure. External stores or load should be jettisoned to prevent an additional hazard upon landing.

**WARNING**

If possible, the aircraft should be autorotated to an area that would not create a hazard to persons or property.

**CAUTION**

When jettisoning external stores from only one side of the aircraft the pilot must be prepared to correct for a rapid change in lateral CG.

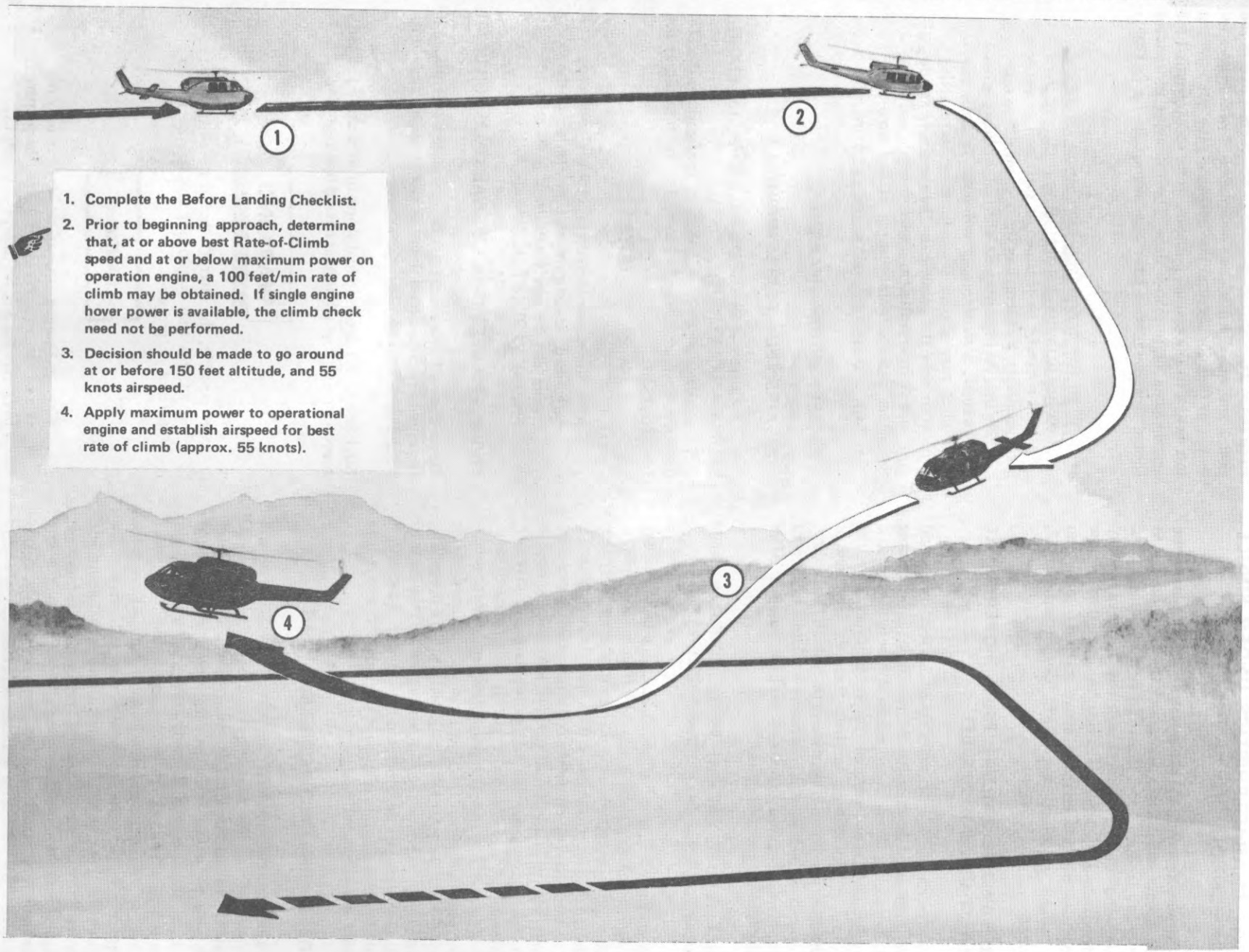



Figure 3-2. Single engine go-around - typical

## ENGINE COMPRESSOR STALLS

The usual indications of a compressor stall are: Torquemeter dropping to zero, decreasing Ng, and an abnormally rapid increasing ITT. An audible rumble, popping or soft explosion sound may or may not accompany the compressor stall. Any time a compressor stall exists, immediately retard the throttle to FLT IDLE, then to SHUT OFF, if a stall is confirmed by continuing ITT rise. A compressor stall should be recorded and investigated regardless of the temperature reached.

## ENGINE RESTART DURING FLIGHT

**CAUTION**

A failed engine should not be started in flight unless it can be determined that it is reasonably safe to do so. Before restarting engine in flight allow 30 seconds of gas generator coastdown with throttle in the OFF position to purge the engine of fumes and fuel. Do not use the bleed air heater during ENGINE RESTART DURING FLIGHT.

## AUTOMATIC START

1. Generator (Inoperative engine) - OFF.
2. Throttle - OFF.
3. Main Fuel Switch - ON.
4. Starter Switch - ENGAGE.
5. Engine Oil Pressure - INDICATING.
6. Throttle - Open to stop at 12% Ng.
7. ITT - Monitor (1090° C Maximum).

**NOTE**

A relight should be obtained within 15 seconds and will be evidenced by a rise in Ng and ITT.

8. Starter - OFF at 50% Ng.
9. Engine Oil Pressure - WITHIN LIMITS.
10. Flight Idle Stop Switch - ACTUATE.
11. Throttle - Increase Slowly to FULL OPEN.
12. Particle Separators - AS REQUIRED.
13. Generator - ON.

## MANUAL START

In the event that the automatic fuel control has failed, in-flight or ground engine starts can be made using manual fuel control only. During cold weather, manual fuel starts can be made if a cold hangup was experienced during a start attempt. The pilot may also elect to use this procedure any time he suspects his battery has insufficient power for ensuring a normal start on the automatic system.

**CAUTION**

Battery starts should not be attempted with battery voltage below 20 volts.

1. Generator (inoperative engine) - OFF.
2. Throttle - OFF.
3. Main Fuel Switch - ON.
4. Engine Governor Switch - MANUAL.
5. Starter Switch - ENGAGE.
6. Throttle - Slowly start opening at 12% Ng, observing fuel flow indications.
7. ITT - Monitor, control ITT and fuel flow rise with throttle.

**NOTE**

A light off should be obtained within 15 seconds and will be evidenced by rise in Ng and ITT.

8. Engine oil pressure - INDICATING
9. Starter - OFF at 50% Ng.
10. Engine Governor Switch - AS REQUIRED

**CAUTION**

If the manual fuel control start was due to a cold weather condition, select AUTO GOV. In the event of uncontrolled engine acceleration, immediately retard the throttle to SHUT OFF. If take-off or continued flight under emergency conditions is required, proceed as follows:

11. Flight Idle Stop Switch - Actuate.
12. Throttle - Increase slowly to Nf desired.
13. Generator - ON.
14. Particle Separator - AS REQUIRED.

**CAUTION**

When operating on Manual Fuel, ITT, Ng, Nf and torque limits can be exceeded. Throttle and collective movement should be relatively slow and smooth to avoid inducing compressor stalls and or exceeding operating limitations.

## ENGINE SHUTDOWN IN FLIGHT

1. Throttle (affected engine) - FLIGHT IDLE
   Prior to an actual engine shutdown in flight, retard the throttle on the affected engine to flight-idle. This will insure and indicate that the operating engine has not been inadvertently selected for shutdown. After confirming the affected engine, proceed with the following:
2. Throttle (affected engine) – OFF.
3. Main Fuel Switch (affected engine) – OFF.
4. Particle Separators – AS REQUIRED.

**CAUTION**

Ensure that the Particle Sep-OFF caution light illuminates during shutdown. Failure of the particle separator door to close could prevent normal engine cool-down and fuel/fumes elimination. It may be necessary to position the particle separator switch to "OFF" to ensure door closure.

5. Generator (affected engine) – OFF.

## SINGLE ENGINE LANDING

Prior to initiating a single engine approach, determine whether power is available to perform a go-around if required. Also determine, considering site elevation, gross weight, and power available, if an approach to touchdown or slide landing will be required, or if single engine hover capability is available. A landing site should be selected that provides a smooth hard surface. Utilize a shallow approach to minimize the rate-of-descent. Do not droop the rotor rpm below 97% if at all possible during the approach and landing. When hover performance is marginal, a slide landing with slightly higher than normal touchdown speed may be required to maintain the rotor rpm within normal operating limits.

## SINGLE ENGINE GO-AROUND

If before landing, it is determined that a safe landing cannot be made and power available is sufficient to continue flight, initiate a go-around as early as possible to regain or maintain airspeed (Refer to figure 3-2).

## FAILURE OF BOTH ENGINES

Under operational conditions, the altitude-airspeed combination for a safe autorotative landing is dependent upon many variables such as pilot capabilities, density altitude, helicopter gross weight, proximity of a suitable landing area, and wind direction and velocity in relation to flight path (figure A-12). This does not preclude operation in the shaded area under emergency or pressing operational requirements. Immediately upon a two-engine failure, rotor rpm will decay and the helicopter will swing to the left. This is due to the loss in power and corresponding reduction in torque. Except in those instances when a two-engine failure is encountered in close proximity to the surface, it is mandatory that autorotation be established by immediately lowering the collective pitch to minimum.

In autorotation the action of the flight controls without power is similar to that of a normal power descent. Full control is maintained by autorotative action of the main rotor and ground contact force is reduced by increasing main rotor pitch prior to landing. Maximum autorotative gliding distances are shown in figure 3-3. Any increase of rotor rpm, other than specified, will result in a greater rate-of-descent.

Rotor rpm will tend to overspeed in autorotation at high gross weight, at high density altitude, and when maneuvering such as in turns and flares, and must be controlled with collective. Banks should be minimized since steep angles tend to increase rate of descent. Initiate any required turns early in the glide so descent rates will resume straight ahead values prior to the flare. Also, the steeper the bank, the more nose down the aircraft attitude will have to be to maintain airspeed. Higher rates of descent develop from this diving attitude and leveling the aircraft after the dive expends valuable rotor system energy. At high altitudes plan to initiate the flare at a higher than normal level to offset the added time required for flight control response. Apply cyclic inputs in a smooth steady fashion to minimize rotor energy loss and to aid in preventing rotor overspeed. Particularly avoid over rotation, taking into account the extra time required to level the aircraft prior to touchdown.

During an autorotative landing a landing attitude should be established a few feet above the ground with sufficient

rotor rpm to cushion the landing. Ground speed should be reduced commensurate with the terrain.

**WARNING**

- In extreme cases, high rates of descent will negate the flare just prior to landing even though the pilot has flare airspeed and ample rpm.
- One of the most common errors is that of landing in a "tail low" attitude. This often results in such rapid "nose down" pitching that the main rotor strikes the tail boom. To avoid tail boom strikes by the main rotor, aft cyclic should not be applied after ground contact is made. Regardless of the force with which the helicopter strikes the ground, damage will be much less if it strikes level.

## TWO-ENGINE FAILURE DURING TAKE-OFF AND CLIMB

**CAUTION**

Ensure that operation within the shaded areas of figure A-12 are kept to minimum.

After the climb has been started, various techniques may be employed to execute a power-off landing. When two-engine failure is experienced, proceed as follows:

1. **ESTABLISH AUTOROTATION.**
2. Engines – SHUTDOWN.

If altitude and airspeed permits, accomplish a flare and reduce airspeed before ground contact. Ground contact should be in a level attitude to minimize airframe damage. After touchdown reduce collective pitch slowly to minimum. Apply rotor brake to stop rotor and reduce rotor blade hazards to personnel exiting the aircraft. Turn off fuel and battery switches prior to exit if time permits.

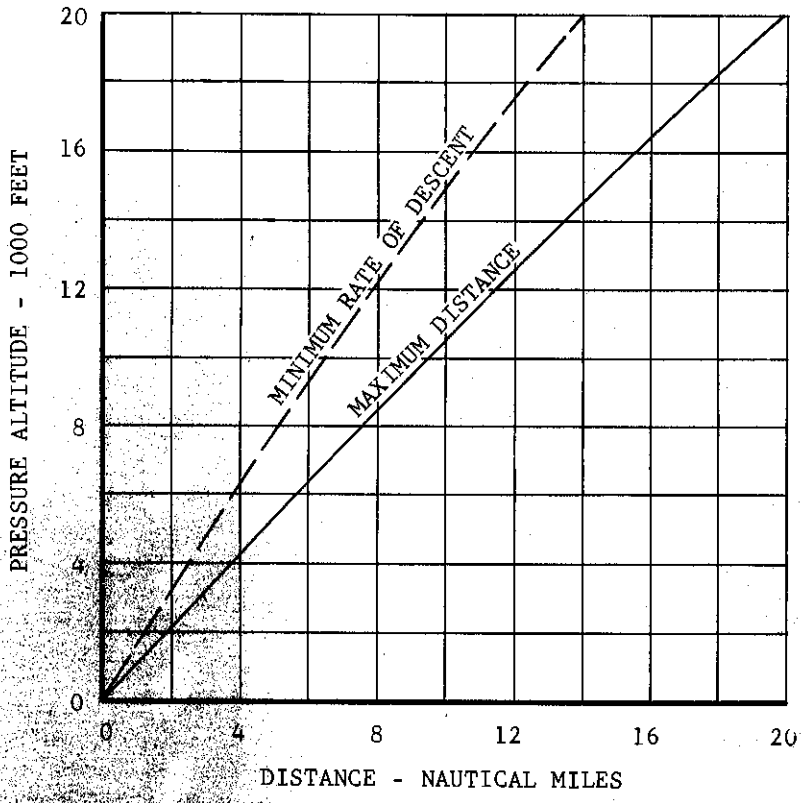
## TWO-ENGINE FAILURE DURING FLIGHT

In the event of a two-engine failure during flight, a safe autorotative landing can be accomplished provided the helicopter is being flown at a safe altitude/airspeed combination and the inflight altitude is sufficient to permit selection of a suitable landing area.

**NOTE**

If time and altitude permit, engine restart may be attempted after engine failure. It is usually better to concentrate on making a safe landing than to use valuable time attempting a restart.

1. **ESTABLISH AUTOROTATION.**
2. **THROTTLES - OFF.**
3. Main Fuel Switches - OFF.
4. Crew/Passengers – ALERTED.




**UH-1N**
**MAXIMUM GLIDE DISTANCE**
**POWER OFF**

**Note**

(1) Autorotational descent performance is a function of airspeed and essentially unaffected by density altitude and gross weight.

(2) The speed for best glide distance is 85 KIAS.

(3) The speed for minimum rate of descent is 60 KIAS.

(4) Rotor Speed 91%.

212947-11B

**Figure 3-3. Maximum glide distance – power off**

Ground contact should be in a level attitude to minimize airframe damage. After touchdown reduce collective pitch slowly to minimum. Apply rotor brake to stop rotor and reduce rotor blade hazards to personnel exiting the aircraft. Turn off fuel and battery switches prior to exit if time permits.

### TWO-ENGINE FAILURE AT HIGH POWER

A two-engine failure at high power, such as high speed, climb, and hover out of ground effect, will result in rapid rotor rpm decay and will be accompanied by a distinct yaw change to the left. Collective pitch must be immediately reduced to prevent excessive loss of rotor rpm and right tail rotor pedal should be applied to compensate for loss of torque to control heading.

**WARNING**

Abrupt lowering of collective and simultaneous forward movement of the cyclic during flight at high power can result in a zero or negative "G" maneuver and subsequent loss of aircraft control.

#### Two-Engine Failure at High Power and Low Speed

Reduce collective pitch to minimum and simultaneously apply forward cyclic stick to regain airspeed to establish a glide at an airspeed of 60 - 70 knots. This action normally requires 400 to 500 feet of altitude if the recovery is initiated at zero airspeed. Accomplish landing as outlined in TWO-ENGINE FAILURE DURING FLIGHT in this section.

#### Two-Engine Failure at High Power and High Speed

If a constant airspeed is maintained while normal recovery procedures are being used, a loss of approximately 300 to 500 feet of altitude will be realized. This altitude loss may be reduced by simultaneously applying aft cyclic stick as the collective pitch is reduced. The rate that aft cyclic stick is applied and the duration of the corresponding nose-high attitude determines the rate of deceleration and/or loss of altitude. Judicious use of collective pitch during the flare, to keep rotor rpm from building up, also reduces the loss of altitude. Accomplish landing as outlined in TWO-ENGINE FAILURE DURING FLIGHT in this section.

### TWO ENGINE FAILURE AT HIGH SPEED AND LOW TERRAIN CLEARANCE

With two engine failure during low level high speed flight, the prime consideration must be given to remaining clear of the ground until the airspeed has decreased to a point that will permit a controlled touchdown. The following procedure should be utilized:

Immediately apply aft cyclic to keep the helicopter from descending. After the nose of the aircraft is above the horizon, smoothly and slowly lower the collective. Do not lower the collective too rapidly as this may induce a near negative "G" condition, allowing the aircraft to enter a rapid descent. Depending upon the rate of control movements, this autorotation entry technique will normally result in an increase of altitude to a point that will insure terrain clearance while the airspeed is being reduced. Accomplish the landing as outlined in TWO-ENGINE FAILURE DURING TAKE-OFF AND CLIMB in this section.

**NOTE**

Avoid abrupt control movement during high speed autorotation to preclude rotor overspeed and/or blade stall.

### GENERAL AUTOROTATION CONSIDERATIONS.

When considering autorotational flight, the following points should be considered:

1. Use of low rotor speed to decrease the rate of descent should be limited to 500 feet or more above the ground.

2. Use of low rotor speed for maximum glide should be limited to 500 feet or more above the ground.

3. Rate of descent is basically controlled by airspeed and rotor speed.

4. An increase in rotor speed will provide a slight increase in rate of descent and a large increase in rotor energy and lift that is needed during the flare and landing.

5. Effectivess of the cyclic flare is dependent upon:
   a. Entry Rotor RPM.
   b. Entry Airspeed.
   c. Rate and Steepness of the Flare.
   d. Gross Weight.
   e. Density Altitude.
   f. Rate of Descent.

6. Effectiveness of collective pitch for landing is dependent upon:
   a. Rotor RPM at Application.

b. Gross Weight.

c. Density Altitude.

d. Rate of Descent at Application.

**NOTE**

It cannot be emphasized enough that high ($N_R$ 97-100%) rotor speeds are required for successful cyclic flares and landing maneuvers during autorotation. This high rotor speed must be attained prior to the landing portion.

## PRACTICE AUTOROTATIONS

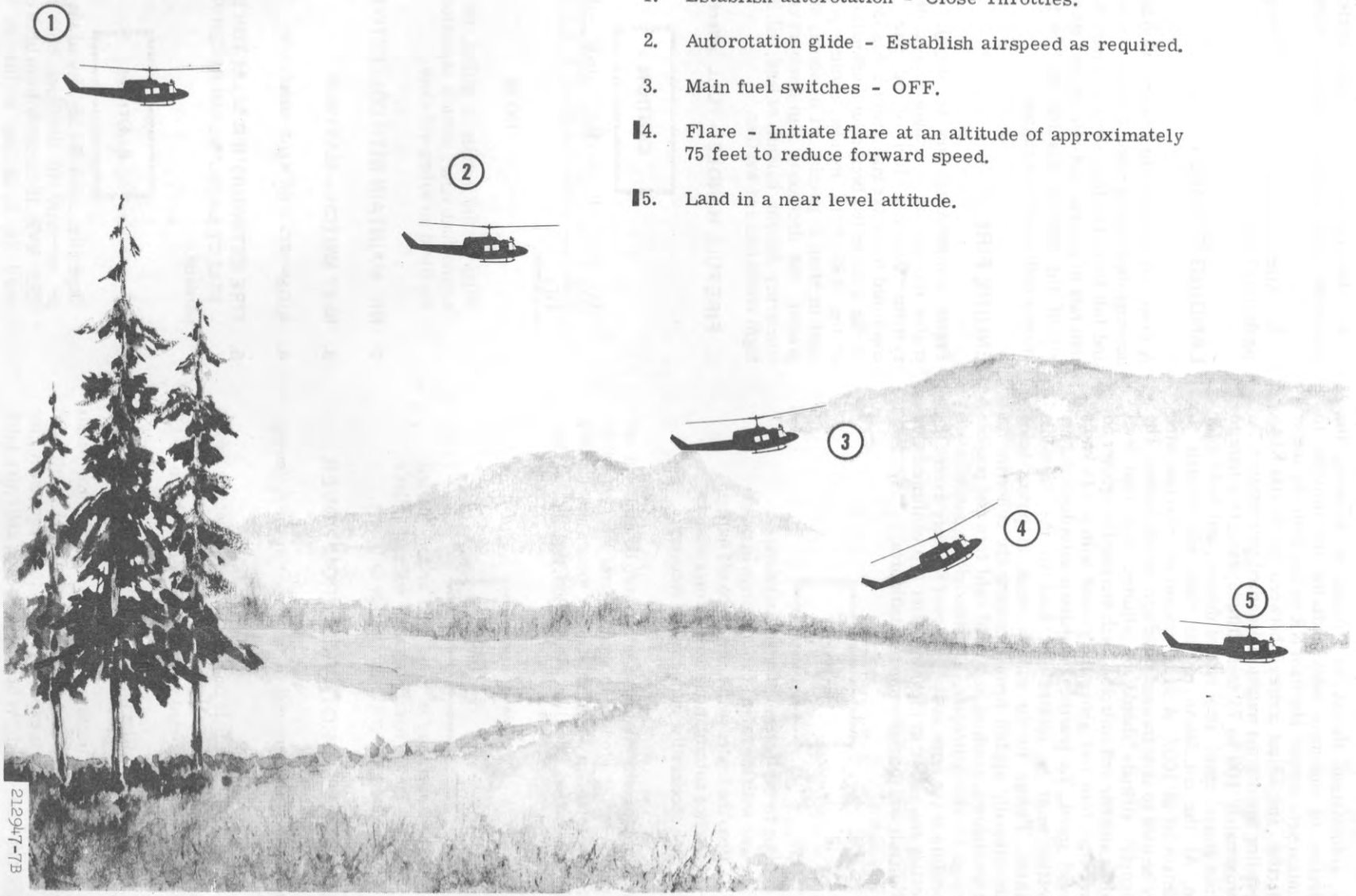
**WARNING**

- Practice autorotations at high density altitudes and or heavy weight from heights below 200 feet above the minimum altitude indicated in Figure A-12, Appendix I, are not permitted. At high gross weights and high density altitudes, it is possible to enter a partial blade stall condition when flaring with high rates of descent which negate flare effect. This condition can be entered even though the pilot has flare airspeed and ample rotor rpm. Recovery from the blade stall is doubtful before ground contact.

- When practicing touchdown autorotational landings, the throttles must be rotated to flight idle. Failure to do so can result in power being unintentionally obtained at touchdown, resulting in a rapid right turn and possible damage to the helicopter.

The condition which must be met during any autorotative landing is to have a landing attitude established a few feet above the ground with sufficient rotor rpm to cushion the landing and a ground speed commensurate with the touchdown terrain.

Glide speeds, flare altitudes, flare rates, and altitude to attain a landing attitude during autorotations are variables depending on pilot judgement, technique and proficiency. There is not one best autorotational procedure which can be universally applied under all conditions.




1. Establish autorotation - Close Throttles.
2. Autorotation glide - Establish airspeed as required.
3. Main fuel switches - OFF.
4. Flare - Initiate flare at an altitude of approximately 75 feet to reduce forward speed.
5. Land in a near level attitude.

**Figure 3-4. Approach and landing – power off – typical**

SEE SUPP 15-102

The autorotation should be entered by lowering the collective to minimum while reducing the throttles to maintain zero torque. Maintain NR within limits by use of collective, and adjust airspeed between 65 to 100 KIAS depending upon gross weight and desired performance. At approximately 100 to 75 feet altitude, execute a flare to reduce ground speed, slow rate of descent, and build rotor rpm. At the conclusion of the flare, add throttle to maintain Nf at 100%. A slight amount of collective pitch may be used to slow forward speed and rate of descent. The helicopter attitude should be adjusted to a near level landing attitude and collective pitch increased to recover no lower than four feet above the ground with a 0-15 knots ground speed. To practice touchdown autorotations, the throttles must be rotated and held to the flight-idle position. Failure to do so can result in power being unintentionally applied upon increasing the collective for the touchdown, resulting in a rapid right turn and possible damage to the helicopter. The touchdown autorotation procedure is the same as for the power recovery except the throttles are placed in flight-idle after it is confirmed that the aircraft will touchdown in a suitable area.

**CAUTION**

Due to the increase of engine acceleration time with the cabin heating system in operation, the heater switch should be off during practice autorotation to assure optimum engine acceleration during power recovery.

During any autorotation, the pilot must be aware of tail proximity to the ground. If a pilot flares late, he will be forced to rotate to a landing attitude sooner and accept a higher touchdown speed to avoid contacting the tail skid.

**CAUTION**

When operating in loose sand or soil, the tail rotor may contact ground without pilot's knowledge causing rotor damage or failure.

## PRACTICE AUTOROTATION FROM HOVER

Hovering autorotations will be performed in the following manner:

1. Establish altitude no higher than four feet above the intended landing site with helicopter heading into the wind, and 0 to 10 knots forward ground speed. Adjust Nf to 100%.

2. Rotate throttles rapidly to Flight Idle.

3. Maintain directional control with tail rotor pedals and increase collective to cushion landing. As throttles as closed, the pilot can expect an immediate requirement for right tail rotor pedal. As helicopter settles, collective pitch should be increased to control rate of descent and cushion landing.

4. Maintain level attitude with cyclic control. Do not touchdown with rearward motion or sideward drift.

5. After firmly on the ground slowly lower collective pitch to minimum.

## LANDING IN TREES

A power-off landing into a heavily wooded area should be accomplished by executing a normal autorotative approach and full flare. The flare should be executed so as to reach zero rate of descent and zero ground speed as close to the top of the trees as possible. As the helicopter settles, increase collective to maximum.

## ENGINE FIRE

Engine compartment fires are usually the result of an engine malfunction or failure of one of the component systems. Ruptured fuel or oil lines will usually be confirmed by engine instrument indications. If the presence of fire is suspected because of illumination of one, or both, of the FIRE PULL handles, confirm presence of fire by sight or smell if possible. If in doubt, or an actual fire is present, the decision to shut down an engine, execute an emergency descent, bailout, or land, will be dictated by the flight conditions and weather.

1. **FIRE PULL HANDLE – PULL (affected engine).**

**CAUTION**

Do not pull the fire handle with the fire extinguisher selector switch in any position but OFF.

**NOTE**

When a fire handle is pulled, the respective engine fuel valve, particle separator door, and the bleed air valves will close.

2. **NR - MAINTAIN WITH COLLECTIVE**

3. **BEEP SWITCH – MAXIMUM**

4. **AIRSPEED – 55 KIAS MINIMUM**

5. **FIRE EXTINGUISHER SELECTOR SWITCH – SELECT MAIN AND/OR RESERVE (if fire persists).**

**CAUTION**

Depending upon the severity of the fire, it may be necessary to discharge both MAIN and RESERVE. If the agent from both containers is used in combating a fire in one engine compartment, no agent will be available should a fire occur in the other compartment.

6. Complete engine shutdown as outlined under ENGINE SHUTDOWN IN FLIGHT.

**CAUTION**

Do not restart the engine as fire may start again.

### CONSECUTIVE FIRES IN ALTERNATE ENGINES

When a fire has been experienced in an engine that necessitated using the engine fire extinguisher system, and a subsequent fire is experienced in the other engine, the following action is required:

1. Apply ENGINE FIRE procedures for first engine fire.

2. Enter Autorotation.

3. Reset actuated FIRE PULL handle.

4. Follow ENGINE FIRE procedure for second engine except select RESERVE instead of MAIN.

### SIMULTANEOUS FIRES IN BOTH ENGINES

1. Enter Autorotation.

2. Throttles – OFF (Both).

3. One fire pull handle – PULL.

4. Select MAIN.

5. Both Main Fuel Switches and Particle Separator Switches – OFF.

6. Return actuated FIRE PULL handle to closed position.

7. Second fire pull handle – PULL.

8. Select RESERVE.

9. Accomplish landing as outlined under TWO ENGINE FAILURE.

## FUSELAGE FIRE

In the event of a fuselage fire the decision to execute an emergency descent or to bail out will be dictated by the flight conditions and crew available.

1. Alert Crew and Designate Crewmember to Fight Fire.

**WARNING**

Prolonged exposure (5 minutes or more) to high concentrations of Bromochloromethane (CB) or its decomposition products results in pronounced irritation of the eyes and nose and should be avoided. Adequate respiratory and eye protection, including oxygen, should be sought as soon as primary fire emergency permits.

If the fire is uncontrollable:

2. Execute Emergency Descent or Bail Out.

## ELECTRICAL FIRE

The electrical circuits are individually protected by circuit breakers which will automatically interrupt power to aid in prevention of fire when a malfunction occurs. In the event of an electrical fire, attempt to isolate the circuits affected by pulling circuit breakers. If the fire persists, land as soon as possible. While in flight, accomplish the following:

1. Alert Crew and Designate Crewmember to Fight Fire.

2. Isolate Affected Circuit.

If flight conditions permit, turn off generator and battery to isolate the problem and land as soon as practical. However, if flight conditions will not permit turning off all electrical power, isolate circuit by pulling the circuit breaker to the affected circuit and turn off the system switches.

**CAUTION**

When complete electrical power is removed, fuel boost pumps will be inoperative. Fuel controls will revert to auto mode, if in manual. The hydraulic solenoid will revert to the on position.

**NOTE**

Flight operation can be maintained without battery and generators; however most instruments will not function. The battery must be turned on to shut down the helicopter in order to actuate the flight idle solenoid and main fuel valves.

## SMOKE ELIMINATION

1. Pilot and Copilot Windows - OPEN.
2. Cabin Ventilators - OPEN.
3. Cargo Doors - OPEN.

**NOTE**

All odors not identifiable by the flight crew shall be considered toxic. Immediately go on 100 percent oxygen if available, ventilate the aircraft, and do not takeoff or, if airborne, land as soon as practical.

## BAIL OUT

Helicopter design, flight characteristics and autorotation qualities virtually eliminate the necessity for bailout. However, emergency egress from the cockpit is difficult and time consuming, especially if the seat armor is installed and the crew is equipped with a standard backpack parachute. If the decision is made to bail out, accomplish the following:

1. Warn crew/passengers and radio position.
2. Trim for level flight.
3. Move crew seats full aft.
4. Disconnect seat belt/shoulder harness and communications leads.
5. Jettison crew doors and slide cargo door full open.

**NOTE**

A sharp kick against the bottom forward corner of the crew doors is required to jettison them after the jettison handle has been pulled.

6. Bail Out.

## EMERGENCY DESCENT

**WARNING**

Extremely high rates of descent will be attained at very low forward speeds, steep bank angles and minimum collective pitch.

There is no set procedure for an emergency descent. Damage to the helicopter or engines must be considered secondary to getting the helicopter on the ground. During an extreme emergency, the condition or type of landing may be the determining factor to the type of emergency descent to be made. If a long distance must be covered to a selected landing site, a dive with power would be most feasible. If a short distance must be covered to a selected landing site, attaining a rapid rate-of-descent with low power, minimum pitch, and slow forward speed is the most practical means of accomplishing an emergency descent.

## EMERGENCY ENTRANCE

Turn external release handle. If door will not jettison, slide or break the pilot's movable windows; reach forward and PULL the internal jettisonable door release. If door will not jettison or cargo door will not open, break door windows or windshield to gain entrance.

## DITCHING

The following discussion is based on general knowledge of helicopter ditching and is presented as a suggested technique rather than a mandatory procedure.

Some of the factors to be considered by the pilot in ditching are altitude, wind velocity and direction, distance from shore, sea state, air and water temperatures, survival equipment available, helicopter condition and possible time delay in rescue.

Overwater bailout of the crew is not recommended as long as controlled flight, including autorotation can be maintained. Recommended speed relative to water for any ditching is zero. If forward speed exists during touchdown, nose-over may occur. In the event of ditching due to anticipated fuel starvation or for any other reason where ditching is eminent but not immediate, much can be done to protect personnel and survival gear if the planned ditching procedure is used. The helicopter will not float. For planned and immediate ditching procedures refer to Figure 3-5.

**WARNING**

Do not abandon helicopter until rotor blades have stopped.

**NOTE**

A sharp kick against the bottom forward corner of the crew doors may be required to jettison them after the jettison handle has been pulled.

## FUEL BOOST PUMP FAILURE

* SEE Supp Is-96

The helicopter is equipped with two electrically driven fuel boost pumps, either of which is capable of supplying sufficient fuel to both engines. A helicopter fuel system failure will not be common because of separate RIGHT and LEFT fuel boost pumps. Failure of a boost pump will be indicated by the master caution light and the appropriate caution segment panel light. In the event of fuel boost pump failure, the engine fuel pump will provide sufficient fuel to its engine to continue operation to a 15,000 ft. service ceiling. However, in order to retain redundency in the system, the following procedures should be used. In the event of a boost pump failure, set fuel crossfeed switch to ON position, which will allow the operative pump to supply

## DITCHING CHART

### PILOT

#### PLANNED DITCHING

1. Crew and Passengers — ALERTED
2. Distress Message — TRANSMIT IFF/SIF-EMERGENCY
3. Survival Equipment — PREPARED
4. Personal Equipment — CHECKED
5. Helicopter — HOVER
6. Door — JETTISON
7. Crew and Equipment — EVACUATE
8. Helicopter — PROCEED APPROX 50 YDS DOWNWIND

    a. Hovering Autorotation
    b. Collective — Continue to Increase
    c. Maintain Level Attitude
    d. Rotor Brake — Apply
    e. Evacuate Helicopter

#### IMMEDIATE DITCHING

1. Autorotation — ESTABLISH MINIMUM RATE OF DESCENT
2. Crew and Passengers — ALERTED
3. Distress Message — TRANSMIT
4. Door — JETTISON
5. Shoulder Harness — LOCKED
6. Engine — SHUTDOWN
7. Crew — ALERTED FOR DITCHING
8. Helicopter — DITCH

    a. Collective — Continue to Increase
    b. Maintain Level Attitude
    c. Rotor Brake — Apply
    d. Evacuate Helicopter

### COPLIOT

#### PLANNED DITCHING

1. Survival Equipment — PREPARED
2. Personal Equipment — CHECKED
3. Door — JETTISON IN HOVER
4. Helicopter — EVACUATE ON PILOT'S COMMAND

#### IMMEDIATE DITCHING

1. Shoulder Harness — LOCKED
2. Personal Equipment — CHECKED
3. Door — JETTISON
4. Brace for Ditching
5. Evacuate Helicopter

### CABIN OCCUPANTS

#### PLANNED DITCHING

1. Survival Equipment — PREPARED
2. Personal Equipment — CHECKED
3. Cabin Doors — OPEN
4. Helicopter — EVACUATE ON PILOT'S COMMAND WITH SURVIVAL EQUIPMENT

#### IMMEDIATE DITCHING

1. Cabin Door - OPEN
2. Seat Belt - FASTENED
3. Personal Equipment - CHECKED
4. Brace for Ditching
5. Helicopter — EVACUATE WITH SURVIVAL EQUIPMENT

**Figure 3-5. Ditching Chart**

* SEE SUPP 15-96

both engines. Pull the failed boost pump circuit breaker (No. 1 or No. 2 FUEL BOOST) to remove electrical power from failed pump.

### ENGINE DRIVEN FUEL PUMP FAILURE

If engine driven fuel pump fails, the engine will flame out due to fuel starvation. Refer to ENGINE FAILURE.

### FUEL CONTROL FAILURE

Malfunctions of either fuel control will be evidenced by abnormal change in RPM or POWER. Due to the twin engine capability of this helicopter, analysis of a fuel control malfunction can by made by the resultant Nf RPM after the failure has occurred and the power demand of the rotor at the time of failure.

### FUEL CONTROL FAILURE TO THE HIGH SIDE, WITH HIGH TOTAL POWER DEMAND.

When the helicopter is operated at a high power demand (more than single engine maximum power), and either fuel control fails to the high side, the failed engine will go to its maximum power, while the unfailed engine will reduce power due to overspeeding of the Nf. A correction should be made by reducing the fuel flow of the failed engine by rolling the throttle to FLT IDLE, which reduces the power from that engine. This allows the Nf to return to within the governed range. This engine can be taken to idle and switched to manual at the discretion of the pilot.

### FUEL CONTROL FAILURE TO THE LOW SIDE, WITH LOW TOTAL POWER DEMAND.

When the helicopter is operated at a low power demand (less than single engine maximum power), and either fuel control fails to the low side, the unfailed engine will assume the total power demand with a resultant Nf approximately 2 percent lower than that selected prior to the failure.

After the failed engine has been identified, that engine's throttle should be retarded to flight idle position, fuel control switch moved from automatic to manual, and the flight continued under manual fuel control system actuation. The unfailed engine will continue to be governed about the selected RPM, but when using high or low power, the RPM must be monitored to prevent inadvertent overspeed.

### FUEL CONTROL FAILURE TO THE HIGH SIDE, WITH LOW TOTAL POWER DEMAND

When the helicopter is operated at a low power demand (less than single engine maximum power), and either fuel control fails to the high side, the failed engine will go to its maximum power. The unfailed engine will reduce power to zero and the resultant Nf being considerably higher than that selected prior to failure. After the failed engine has been identifled, that engine's throttle should be rolled back to a "FLT IDLE" setting reducing the fuel flow and power to give the desired Nf reading. Adjustment of the collective and the throttle will allow full power to be utilized at the pilot's discretion.

The failed engine can be rolled to idle and switched to manual if desired by the pilot.

### FUEL CONTROL FAILURE TO THE LOW SIDE, WITH HIGH TOTAL POWER DEMAND.

When the helicopter is operated at a high power demand (more than single engine maximum power), and either fuel control fails to the low side, the unfailed engine will attempt to assume the total power demand by going to its maximum power. The Nf will decrease to a level dependent upon the difference between the total power demand and power available on the unfailed engine. The collective should be reduced sufficiently to return the Nf to the operating range.

Further reductions of collective will show the Nf to remain within the operating limits as power is reduced, indicating the powered engine is operating normally, and that the low engine has had a fuel control failure to the low side. The engine with the failed fuel control can then be rolled to flight idle and switched to manual at the pilot's discretion.

### Nf ACTUATOR FAILURE TO FULL INCREASE

Rotor and Nf RPM will increase to approximately 101%. If this failure occurs during take-off or landing, no immediate corrective action is necessary to complete either maneuver. As soon as practical, roll back both throttles to maintain 97 to 100% RPM. Further adjustment of the collective and the throttles simultaneously will allow full power at the pilot's discretion.

### MANUAL FUEL CONTROL SYSTEM ACTUATION

1. Throttle - FLIGHT IDLE (Maintain NR with collective).

**CAUTION**

[redacted]

2. Governor Switch - MANUAL.

**NOTE**

Confirm shift of fuel control from automatic to manual mode by observing changes or fluctuations in Ng, TIT and fuel flow.

3. Throttle - INCREASE (To power required to maintain flight).

**NOTE**

Torque on the manually controlled engine should be increased to slightly less than that of the governed engine. This setting will permit minor power changes to be made without changing throttle on the affected engine. It is not necessary to maintain matched torque conditions. Major power changes will require minor throttle change. Refer to LANDING WITH MANUAL FUEL CONTROL SYSTEM ACTIVATED.

**CAUTION**

Care must be exercised when operating on manual fuel to preclude engine compressor stall,turbine overspeed,transmission overtorque, or excessive ITT as automatic fuel governing is not provided.

## LANDING WITH MANUAL FUEL CONTROL SYSTEM ACTIVATED

1. Maintain Nf between 97% and 100% RPM.

2. Execute a Shallow Approach to a Slide on or Hover Landing as Terrain Dictates.

3. After landing, closely monitor Nr and coordinate throttle reduction on affected engine as power is reduced.

To practice manual fuel operation in flight, reduce throttle to flight idle and move GOV switch to MANUAL. Adjust Nf with throttle.

## OIL STARVATION

Engine, combining gearbox, or transmission oil starvation may be indicated by decreasing pressure and by illumination of the MASTER CAUTION LIGHT, in conjunction with CAUTION PANEL segment lights, OIL PRESSURE, XMSN OIL PRESS, XMSN OIL HOT, or C BOX OIL PRESS.

### ENGINE OIL SYSTEM

Engine failure will progress slowly until just prior to complete seizure, then the rate of failure accelerates rapidly. The time interval from the moment of oil starvation to complete failure depends on such factors as condition of the bearings, operating temperatures of the bearings, and the bearing loads. A good possibility exists for several minutes of operation after experiencing a complete loss of lubricating oil. Bearing failure due to oil starvation is generally characterized by a rapidly increasing rate of vibration. When the rate of vibration increases from moderate to heavy, complete bearing failure is only seconds away and the engine should be shut down. Since the end result of oil starvation is engine seizure, the affected engine should be shut down immediately, unless critical power requirements exist. If power is required from the affected engine, any reduction or change of power should be held to a minimum.

### COMBINING GEARBOX OR TRANSMISSION OIL SYSTEM

Oil starvation will result in the system failing at an unknown time interval. The pilot should land as soon as possible with minimum power setting. Over water, a ditching may be prevented by heading for the nearest landing site at a reduced airspeed (approximately 70 KIAS) and low altitude. The altitude should be sufficient to permit a quick flare followed by ditching at first sign of actual failure.

**WARNING**

Oil starvation may result in a complete system failure. The pilot should maintain a minimum of 50 KIAS during landing approach descent in the event an autorotation may be required.

## ELECTRICAL POWER SYSTEM FAILURE

Complete failure of the electrical system is improbable because the primary d-c power normally supplied by the generators will be furnished by the battery in the event of both generator's failure. Evidence of generator failure will be indicated by illumination of the DC GENERATOR fault light and the MASTER CAUTION light. Check starter switch OFF and attempt to reset as follows:

NO. 1 or NO. 2 GEN FIELD circuit breaker in overhead console, push to check, move generator switch to RESET and return to ON, then RESET the Master Caution Light to extinguish caution panel light. If the generator has failed, turn off all unnecessary electrical equipment and land as soon as practical.

**NOTE**

If equipment powered by the Non-Essential Bus is required, the Non-Essential Bus Switch must be in the MANUAL position.

## BATTERY FAILURE.

Due to the unique characteristics of the Nickel-Cadmium battery, serious problems can develop as a result of over voltage during recharging or blockage of either one of its vent lines, resulting in overheating, shorting, overflowing and subsequent battery destruction. If overheating is suspected or recognized by smoke or unusual odors from the battery, the battery switch should be turned off and a landing made as soon as practical, shut down helicopter and evacuate. Do not attempt to remove the battery.

## AC INVERTER FAILURE

Failure of the main inverter will be evident by illumination of the MASTER CAUTION light and the AC FAIL fault light located on the CAUTION PANEL. In the event of main inverter failure, check the MAIN INV PWR control circuit breakers by pushing IN. If main inverter power is

not restored, position INVTR switch to STBY. Master caution and AC FAIL segment will reset if spare inverter restores power.

**NOTE**

If MAIN inverter fails STBY will not power RADAR ALT and UHF-DF.

### HYDRAULIC POWER SYSTEM FAILURE

### SINGLE FAILURE

Failure of either No. 1 or No. 2 hydraulic systems will be evidenced by illumination of MASTER CAUTION LIGHT and HYD SYS 1 or HYD SYS 2 caution panel segment lights. Control motions and pressures will be normal except that the tail rotor pedals will be harder to move if the No. 1 system has failed.

1. Hydraulic Control Circuit Breaker - IN
2. Hydraulic Selector Switch - BOTH
3. If System Still Fails, Select Operative System.
4. Master Caution Light - Reset, if system still failed.
5. Land as soon as practical.

### DUAL FAILURE

1. Airspeed - Adjust for minimum control forces.

**NOTE**

Normally an airspeed of approximately 70 KIAS will provide the least amount of feedback.

2. Hydraulic MASTER Switch - ON
3. Hydraulic Control Circuit Breaker - OUT, then back IN

**NOTE**

There is a possibility that a partial or total loss of hydraulic power could be the result of an electrical short circuit to the solenoid operated shut-off valve. Pulling the HYD CONT circuit breaker out may restore hydraulic power. If this procedure does not restore hydraulic power, then the circuit breaker must be reset to restore the function of the Hydraulic Master switch.

4. Hydraulic MASTER Switch - OFF, if power has not been restored.
5. Land as Soon as Possible.

**WARNING**

Extremely high control forces should be expected, making it difficult and perhaps impossible to maintain straight and level flight. If control can be maintained, a slide on landing at 15 - 20 knots is recommended. Landing area should be selected to allow a shallow approach and slide landing.

### RECOVERY FROM COLLECTIVE BOUNCE

During flight or ground operation if vertical oscillation is experienced, one or more of the following procedures will aid recovery.

1. Break elbow (i.e. do not stiff arm collective stick).
2. Increase pilot's adjustable collective friction.
3. Make a positive change of collective position, either up or down.

### VIBRATIONS.

Should an object (door, window, inspection panel, etc.) be inadvertently lost during flight, land at the nearest suitable landing area if a vibration is experienced and inspect the main and tail rotor systems. If a vibration is not experienced and the crew cannot visually confirm that the object cleared both rotor systems, land at the nearest airfield and perform the same inspection. Possible damage may not be felt in the controls or be visually detected with rotors turning.

### TAIL ROTOR FAILURES

A common tendency among helicopter pilots is to attempt to put all types of tail rotor malfunctions, and the corrective actions into a single category with a single solution. This is definitely not correct and any attempt to propose a single solution (emergency procedure) for all types of anti-torque malfunctions could prove disastrous.

The key to successful handling of a tail rotor emergency lies in the pilot's ability to quickly recognize the type of malfunction and to select the proper emergency procedure. Following is a discussion of some types of tail rotor malfunction's and their probable effects.

### COMPLETE LOSS OF TAIL ROTOR THRUST

This is a situation involving a break in the drive system, such as a severed driveshaft, wherein the tail rotor stops turning and delivers no thrust. A failure of this type, in powered flight, will always result in the nose of the helicopter swinging to the right (left side slip) and usually a roll of the fuselage. Nose down tucking will also be present. The severity of the ship's initial reaction will be affected by airspeed, cabin-loading, center of gravity, power being used, and density altitude.

**WARNING**

Extended flight is not possible after complete loss of tail rotor thrust. Throttles must be chopped immediately and rotor RPM maintained above minimum limits with collective.

**Corrective Action**

1. HOVERING. Chop throttles immediately and make a hovering autorotation landing. A slight rotation can be expected on touchdown.

2. CLIMB. Chop throttles and lower collective pitch immediately. Establish a glide speed slightly above normal autorotation approach speed. With the higher power required in a climb maneuver, the degree of right yaw will be greater. If a turn is required to reach a more desirable place to land or to align into the wind; make it to the right. A turn to the right can be more nearly streamlined by the use of a little power. Once aligned for landing, maintain heading in the following manner:

a. If the nose is turning to the right with power off, a pulse of up-collective will produce more friction in the mast thrust bearings creating a left moment. The greater the input of the pulse, the more the response should be.

**NOTE**

By moving the collective upward rapidly, you create more load on the rotor. Do not hold the collective up, as the rpm will decrease lower than desirable. It is essential that the collective is returned to the down position for autorotation. This cycle is one pulse. The pulse should be rapid (up and down) and not used at low altitudes.

b. Should the nose turn left with power off, a slight addition of throttle should arrest it. Further increase in power results in more right turn response.

c. During the final stages of the approach, a mild flare should be executed making sure that all power to the rotor is OFF. Maintain the helicopter in a slight flare and use the collective smoothly to execute a soft, slightly nose-high landing. Landing on the aft portion of the skid will tend to correct side drift. This technique will, in most cases, result in a slide type landing.

**NOTE**

If time permits level flight or powered descent may be attempted (See note after Step 3 below).

3. LEVEL FLIGHT OR POWER DIVE. Chop throttle and reduce pitch immediately. Attain an airspeed slightly above the normal autorotative glide speed.

**NOTE**

If altitude permits with airspeed above 60 knots, throttle and pitch can be gently applied to see if some degree of powered flight can be resumed. If any adverse yawing is experienced, re-enter autorotation and continue descent to a landing. The landing technique is the same as prescribed for the climb condition, in paragraph 2., step c. above.

4. DESCENT (LOW POWER OR POWER OFF).

a. If the throttles are not at idle at the time of the failure, roll then to idle.

b. Proceed as prescribed in the previous condition of level flight, step 3. above.

**Zero Ground Speed Landings**

1. If it is essential that the landing be made at zero ground speed, the only change in the technique described previously is that the flare will be more positive.

2. The flare should be executed more steeply and will require a more rapid forward cyclic input to land as near level as possible. A more positive and rapid use of collective also will be necessary. The flare should be executed as close to the ground as possible.

**CAUTION**

The flare and the rapid movement of collective will cause the nose to rotate left, but do not correct with throttle. Although application of throttle will result in rotation to the right, addition of power is a very strong response measure and is too sensitive for the pilot to manage properly at this time. DO NOT ADD THROTTLE AT THIS TIME. Slight rotation at time of impact at zero ground speed should not cause any real problem.

## LOSS OF TAIL ROTOR COMPONENTS

The loss of any tail rotor components will result in a forward center of gravity shift. Other than additional nose down trim, this situation would be quite similar to complete loss of tail rotor thrust as discussed above.

### FIXED PITCH FAILURES

Failure of this type (broken control rod, jammed slider, etc.) are characterized either by a lack of directional response when a pedal is pushed or the pedals will be in a locked position. If the pedals cannot be moved with a moderate amount of force, do not attempt to apply a maximum effort, since a more serious malfunction and set of circumstances could result. If the helicopter is in a trimmed condition when the malfunction is discovered, the engine power and airspeed should be noted and the aircraft flown to a suitable landing area. Combinations of engine torque, rotor rpm, and airspeed will correct or aggravate a yaw attitude and these are what will be used to land the aircraft.

#### Corrective Actions

1. HOVERING. Do not chop throttles unless a severe right yaw occurs. If pedals lock in any position at a hover, landing from a hover can be accomplished with greater safety under power controlled flight rather than by chopping throttle and entering autorotation.

2. FORWARD FLIGHT. If control is lost during climb (left pedal forward), cruise (approximately neutral pedals), and descent (pedal displaced to right), a descent and landing can be safely effected by use of power and throttle changes.

a. Right Pedal Locked Forward of Neutral:

(1) Power should be reduced and engine rpm maintained within the green arc. This will help streamline the helicopter in flight. Normal turns to the right are easier than left turns, but airspeed should be maintained.

(2) Execute a shallow to normal approach, maintaining engine rpm and an airspeed of about 60 knots during the initial part of the approach.

(3) At 50 to 75 feet AGL and when the landing area can be made, start a slow deceleration to arrive at the intended landing point with about 25 knots indicated airspeed.

(4) At 2-5 feet AGL, slowly reduce throttle to overcome the yaw effect and allow the helicopter to settle. When aligned with the landing area, allow the aircraft to touch down. After ground contact use collective and throttle as necessary to maintain alignment with the landing strip, and minimize forward speed. If the helicopter starts to turn, move the cyclic as necessary to follow the turn until the ship comes to a complete stop.

b. Left Pedal Locked Forward of Neutral:

(1) Reduce power and maintain engine rpm within the green arc. Normal turns can be safely made under these conditions although the ship's nose may be displaced to the left (depending on how far the pedal is forward). Maintain about 60 knots during the initial part of the approach.

(2) On final approach, reduce throttles to minimum operating rpm (91% NR) and simultaneously begin a slow deceleration so as to arrive at a point about two feet above the intended touchdown area as effective translational lift is lost.

(3) Apply collective pitch (maintaining minimum operating rpm) to stop the rate of descent, forward speed, and to align the helicopter with the intended landing path. If not aligned after pitch application, increase the throttles to further help with the alignment. Allow the ship to touch down at near zero ground speed, maintaining alignment with the throttles.

c. Pedals Locked in Neutral:

(1) Reduce power and maintain engine rpm within the green arc. Normal turns can be safely made under these conditions. Execute a shallow approach, holding 60 knots indicated airspeed during the initial part of the approach.

(2) At 50 to 75 feet AGL and when the landing area can be made, start a slow deceleration to arrive at the intended landing point with 25 knots indicated airspeed.

(3) At 2-5 feet AGL, use throttle slowly as necessary to maintain alignment with the landing area and overcome yaw; do not allow the helicopter to settle until alignment is assured, then effect a touchdown. After ground contact, use collective and throttle as necessary to minimize forward speed and to maintain alignment. Move the cyclic as necessary to follow the turn until the ship has come to a complete stop.

### LOSS OF PITCH-CHANGE CONTROL LINKAGE

In this type of failure the pitch-change mechanism is broken at some point and the tail rotor will assume a blade angle determined by the aerodynamic and counter-balance forces.

#### Corrective Action

The corrective action procedure is described in FIXED PITCH FAILURES, paragraph a, b, or c. above, depending on the yaw change experienced.

## SYNCHRONIZED ELEVATOR CONTROL FAILURE

**When synchronized elevator control fails during forward flight, a nose down pitching will occur. The amount of pitchdown is proportionate to forward speed and/or forward center of gravity loading. Decrease helicopter airspeed and land as soon as possible.**

## RPM WARNING

### LOW RPM WARNING

Comfirm engine failure by low RPM light and engine instruments prior to shut down of engine or making an autorotative landing. If a check of engine instruments

indicates that the engine is operating properly, flight can be continued.

### HIGH RPM WARNING

If the warning light only illuminates, maintain rotor rpm within operating limits.

### ENGINE CHIP DETECTORS

If an engine chip detector light illuminates, reduce the affected engine throttle to flight-idle and land as soon as practical. Monitor the affected engine instruments and upon any indication of an actual malfunction, shut down the engine. If the operating capability of the unaffected engine is questionable, land as soon as possible.

### CHIP DETECTOR CAUTION PANEL

**Over Land.** If any of the four caution lights illuminate, land as soon as possible. Flight should not be resumed until the cause has been determined and corrected.

**Over Water.** If any of the four caution lights illuminate, a ditching may be prevented by heading for the nearest landing site (either ship or shore). Establish a slow cruise speed (approximately 70 knots) at a low enough altitude to permit a quick flare followed by ditching at first sign of an actual failure.

## CAUTION AND WARNING LIGHT – INITIAL ACTION

When caution and warning lights are illuminated the crew should refer to aircraft instruments to verify a malfunction exists, then accomplish the actions and procedures as follows for confirmed emergencies:

| SEGMENT WORDING | FAULT CONDITION | CORRECTIVE ACTION |
|---|---|---|
| **MASTER CAUTION LIGHT** | | Check the CAUTION PANEL for the fault. |
| | CAUTION PANEL | |
| OIL PRESSURE (ENG 1 & 2) | Engine oil pressure below 30 psi. | Check instruments to verify. Reference OIL STARVATION, Section III. |
| CHIP DETECTOR (ENG 1 & 2) | Metal particles in engine. | Reduce power as soon as possible. Reference ENGINE CHIP DETECTORS, Section III. |
| DC GENERATOR (1 & 2) | Failure of DC generator. | Check starter switch OFF. GEN FIELD circuit breaker – Check IN. RESET GENERATOR SWITCH. Reference ELECTRICAL POWER SYSTEM FAILURE, Section III. |
| GOV MANUAL (ENG 1 & 2) | Governor in manual mode. | No corrective action required. Reference MANUAL FUEL CONTROL SYSTEM ACTUATION, Section III. |
| FUEL FILTER (ENG 1 & 2) | Filter is partially clogged. | No inflight corrective action possible. Continue flight, and correct before next flight. |
| PART SEP OFF (ENG 1 & 2) | Particle separator door closed. Ice and dust protection system inoperative. | Position particle separator switch to "ON."<br><br>If light extinguishes, continue flight. The particle separator switch should be returned to "AUTO" after landing but before shutdown.<br><br>If light doesn't extinguish, return the particle separator switch to "AUTO" and reduce power on affected engine to 30% of engine torque except as needed for landing. |

| SEGMENT WORDING | FAULT CONDITION | CORRECTIVE ACTION |
|---|---|---|
| AC FAIL | Failure of inverter. | Check MAIN INV PWR circuit breaker – IN. Reference AC INVERTER FAILURE, Section III. |
| HYD SYS (1 & 2) | Hydraulic pressure, Sys 1, below 650 psi. | Land as soon as possible. Reference HYDRAULIC POWER SYSTEM FAILURE, Section III. |
| ROTOR BRAKE | Hydraulic pressure of 10 psi sensed. Puck(s) not fully retracted. | If the brake has not been intentionally applied, check the rotor brake handle – OFF. During flight, if the light remains on, land as soon as possible. |
| EXTERNAL PWR | External power access door open. | If the door has not been intentionally opened for connection of the external power, check door closed. |
| LEFT OR RIGHT FUEL BOOST | Left/Right fuel boost pump off. | Set fuel crossfeed switch – ON. Circuit breaker to affected pump – PULL. Reference FUEL BOOST PUMP FAILURE, Section III. |
| C BOX OIL FILTER | Combining gearbox oil filter partially clogged. | Land as soon as practical and correct before next flight. |
| IFF CODE HOLD | Code hold switch ON. | None. Indicates IFF MODE 4 switch has been actuated. |
| FUEL LOW | Fuel quantity 150 ± 40 lbs | Land as soon as practical. |
| C BOX OIL PRESS | Combining gearbox oil pressure below 30 psi. | Begin minimum power descent. Reference OIL STARVATION, Section III. |
| IFF | IFF MODE 4 inoperative. | No inflight corrective action possible. Indicates IFF MODE 4 inoperative. |
| AUX FUEL LOW | Auxiliary fuel tank empty | Applicable AUX FUEL TRANSFER PUMP switch – OFF. Reference AUXILIARY FUEL TRANSFER, Section IV. |
| XMSN OIL HOT | Transmission oil temperature is above 110° C. | Begin minimum power descent. Reference OIL STARVATION, Section III. |
| XMSN OIL PRESS | Transmission oil pressure below 30 psi | **Begin minimum power descent. Reference OIL STARVATION, Section III** |
| CHIP DETECTORS | Metal particles in oil. | Refer to CHIP DETECTOR PANEL which will indicate which gearbox has the fault. |

| SEGMENT WORDING | FAULT CONDITION | CORRECTIVE ACTION |
|---|---|---|
| ALT ENCODER | AC power interrupted | No inflight corrective action possible. Indicates ALT ENCODER inoperative. |
| | CHIP DETECTOR PANEL | |
| 90° | Metal particles in oil | Begin minimum power descent. Reference CHIP DETECTOR CAUTION PANEL, Section III. |

| SEGMENT WORDING | FAULT CONDITION | CORRECTIVE ACTION |
|---|---|---|
| C BOX | Metal particles in combining gearbox. | Same as 90° |
| 42° | Metal particles in oil. | Same as 90° |
| XMSN | Metal particles in oil. | Same as 90° |
| | FIRE DETECTOR/WARNING LIGHTS | |
| FIRE 1 PULL | Fire indication in No. 1 engine compartment. | Reference ENGINE FIRE, Section III. |
| FIRE 2 PULL | Fire indication in No. 2 engine compartment. | Same as FIRE 1 PULL. |
| | RPM WARNING LIGHT | |
| RPM | Rotor is too low or high. | Maintain NR within limits and check for engine failure. |