SECTION II

NORMAL PROCEDURES

TABLE OF CONTENTS

PREPARATION FOR FLIGHT.

FLIGHT RESTRICTIONS.

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

KNEELING.

The helicopter may be kneeled or unkneeled (normal) any time deemed necessary by the aircrew. Kneeling may be accomplished while engines are running; however, the helicopter should be in the unkneeled position during rotor engagement. The kneeling position can be utilized for convenience such as personnel door and aft ramp loading, slope landing, beaching, etc.

FLIGHT PLANNING.

The required fuel, airspeed, and power settings for takeoff, climb, cruising, hovering, and landing may be determined by reference to the performance data charts in Appendix.

NOTE

Airspeeds will be KIAS unless otherwise specified.

TAKEOFF AND LANDING DATA CARD.

Complete the takeoff and landing data card. Instructions for filling out the card are in the Appendix. The Takeoff And Landing Data Card (TOLD CARD), located in the Flight Crew Checklist, T.O. 1H-3(C)E-1CL-1, is designed as an aid in assuring safe and efficient mission planning. A TOLD card must be filled out for each flight. If conditions at the landing site are more favorable than for takeoff, use of the landing data is optional. The takeoff gross weight limitation can be determined for the applicable charts. Terrain conditions, surface conditions, and obstacles will dictate whether the in ground effect power and weight limitations or the out of ground effect power and weight limitations shall be used for planning the takeoff and landing gross weights and determining the type of takeoff to be made.

WEIGHT AND BALANCE.

The takeoff and anticipated landing gross weight will be obtained prior to each mission and determined to be within specified limitations. If a locally standardized weight and balance clearance, Form 365-4, is not on file showing the helicopter to be within limits, a Form 365-4 will be completed. The load adjuster may be used to compute the Form 365-4. For additional information refer to LOAD ADJUSTER in Section IV, WEIGHT LIMITATION, Section V, Manual of Weight and Balance Data, T.O. 1-1B-40; Basic Weight Check List and Loading Data, T.O. 1H-3(C)E-5; Cargo Loading Manual, T.O. 1H-3(C)E-9, and USAF Aircraft Weight and Balance, T.O. 1-1B-50.

CHECKLIST.

The instructions contained in this flight manual should be complied with. However, every phase of operation shall also be presented in checklist form. When possible, the flight crew will perform each phase of action with a direct reference to a checklist. However, it would be impractical and unsafe to require the use of a checklist during actual landing, takeoff, taxiing near aircraft, buildings, or other hazards; or in certain emergency situations.

Checklist Responses.

For checklist purposes the pilot occupying the right seat will always respond as the pilot and the pilot occupying the left seat will respond as the copilot. The pilot flying the helicopter will normally initiate all checklists and when a checklist item is followed by a crew position designation; ie (P), (CP), (FE), etc, that crewmember takes the action. When a checklist item is followed by the crew position designation (P/CP), either crewmember takes the required action. If the action is in quotes, he reports that action to the person reading the checklist. When a checklist item requires a response by more than one crewmember, the crewmember will state the response and his crew position with the pilot flying normally responding first. If the action is not in quotes, he completes the action and remains silent. During accomplishment of any checklist, AS REQUIRED will not be used as a response; instead, the actual position or setting of the unit and/or item will be stated. Items of the checklist not applicable to the model, series, or configuration being operated may be omitted.

Thru-Flight Checklist.

The thru-flight checklist is to be accomplished only when the helicopter is assigned missions which require intermediate stops, including shutdown, by the same flight crew with no crew rest, and when no maintenance other than servicing is performed during these stops. Thru-flight checklist items are indicated by an asterisk. These items must be accomplished during an intermediate stop. The remaining items may be accomplished at the pilot's discretion. All items under ENGINE STARTING AND ROTOR ENGAGEMENT and subsequent checks should be accomplished as thru-flight checklist items.

Abbreviated Before Takeoff Checklist.

When the complete Before Takeoff checklist has not been accomplished, the abbreviated Before Takeoff checklist, identified by double asterisk items, will be used subsequent to the first takeoff of a flight providing no major change in aircraft configuration or basic crew has been made. Examples when this checklist may be used are:

Passenger stops or after landings where throttles have been retarded.

Traffic Pattern Checklist.

The Traffic Pattern checklist is designed for use when multiple closed traffic patterns are to be performed to an authorized transition area or remote site. This check should be performed prior to final approach. Upon arrival in the area, the before landing checklists will be performed. On leaving the area, the after takeoff checklist will be performed.

PREFLIGHT CHECK.

The pilot is responsible for ensuring the preflight check is completed. He may delegate these tasks to other crewmembers.

NOTE

The pilot preflight inspection outlined in this section is predicated on maintenance personnel completing the Aircraft Schedule Inspection and Maintenance Requirements, T.O. 1H-3(C)E-6WC-1, for preflight. When operating from areas where maintenance personnel are not available to perform these requirements, the pilot will insure that the preflight inspection is accomplished in accordance with T.O. 1H-3(C)E-6WC-1.

BEFORE EXTERIOR INSPECTION.

*1. Aircraft grounded and chocks in place. (P/FE)

*2. Fire extinguisher — POSITIONED OUTSIDE AIRCRAFT. (P/FE)

*3. Weapons safety check — GUNS SAFETIED AND STOWED. (P/FE)

*4. Aircraft forms and flight publications — CHECKED. (P/FE)

*5. Flare case jettison switches — OFF AND SAFETIED. (P/FE)

EXTERIOR INSPECTION.

The exterior inspection will normally be accomplished by the flight engineer and is not required when a member of the flight crew performs the preflight in accordance with TO 1H-3(C)E-6WC-1. Subsequent preflights by the same engineer may be accomplished using the thru-flight checklist.

1. Right front fuselage.

   a. Covers, plugs and tiedowns — REMOVED.

   b. Pilot's window emergency release handle — SECURED.

   *c. Access panels — SECURED. Closed and undamaged.

   *d. Engine drain line sump — CHECKED. Drain prior to flight (as required).

   e. Cargo Sling — CHECKED. Check for proper rigging of cables, security of suspension frame, pulleys, and hook release system.

2. Upper right fuselage.

   a. Engine oil level — CHECKED. Oil cap secured.

   b. Engine inlet — CHECKED. Free of foreign matter and loose objects. Starter for security.

   c. Engine — CHECKED. Free of leaks and general security.

   d. Engine exhaust section — CHECKED. No evidence of cracks and FOD, tail pipe aligned.

   e. Engine door — CHECKED. Locking mechanisms for wear, door for proper closing and security. Door closed.

   *f. Main gear box — CHECKED. Free of leaks and damage.

   g. Emergency gear extension bottle — CHECKED. Pressure up (2500 - 3000 psi), no leakage.

   *h. Transmission deck — CHECKED. Free of leaks.

   *i. Main rotor blades — CHECKED. Undamaged, pockets aligned and IBIS indicators seated.

WARNING

If a pressure indicator shows any red color, the helicopter shall not be flown until maintenance has been performed. This may be an indication of blade damage that is a flight hazard.

j. Main rotor head fairing — CHECKED. Undamaged and secure.

*k. Damper reservoir — CHECKED. Serviced to correct level.

*l. Main rotor head reservoirs — CHECKED. Serviced and free of leaks.

m. Main rotor head assembly and control linkages — CHECKED. Properly aligned and undamaged.

n. Utility hydraulic reservoir — CHECKED. Serviced and access door secured.

o. Rotor brake hydraulic reservoir — CHECKED. Serviced and free of leaks.

*p. Hydraulic power packages and utility heater exchanger — CHECKED. Free of leaks, security, and not in bypass condition. Access doors secured.

q. Fire extinguishers — CHECKED. Correct pressure. Access doors closed.

*r. Main rotor head fairing access panels — SECURED. Closed and free of damage.

3. Upper transmission section and tail.

a. Antennas — CHECKED. Secure, clean and undamaged.

b. Stabilizer — CHECKED. Security and condition.

c. Anti-collision light — CHECKED. Check for cracks and security.

*d. Tail rotor gear box — CHECKED. Gear box for proper servicing, leakage and security.

WARNING

To avoid personal injury while checking the tail rotor gear box, do not exert any external force on the tail rotor blades while working around the tail rotor star, as the negative force gradient spring may cause the blades to drive to the fully released (Star in) position.

*e. Tail rotor hub — CHECKED. Reservoir for servicing, linkage for alignment, wear and undamaged.

*f. Tail rotor blades — CHECKED. Undamaged, clean, and secured.

*g. Access steps — CHECKED. Proper operation and secured.

*h. Transmission work platform — SECURED. Closed, locked, and free of damage.

4. Right sponson.

a. Sponson and auxiliary tanks — CHECKED.

Tank safety pin installed, secure, free of leaks and damage, fuel quantity checked, filler cap secured. Check release lever and electrical solenoid plunger for proper position (see figure 1-32).

b. Main gear and tires — CHECKED. Gear pin installed, free of leaks and damage.

*c. Removable cabin windows — CHECKED. Ensure window is properly installed.

5. Right rear fuselage.

a. Flare case — CHECKED. Loaded, securely mounted, and safety pin installed.

WARNING

Stay clear of area below loaded flare cases.

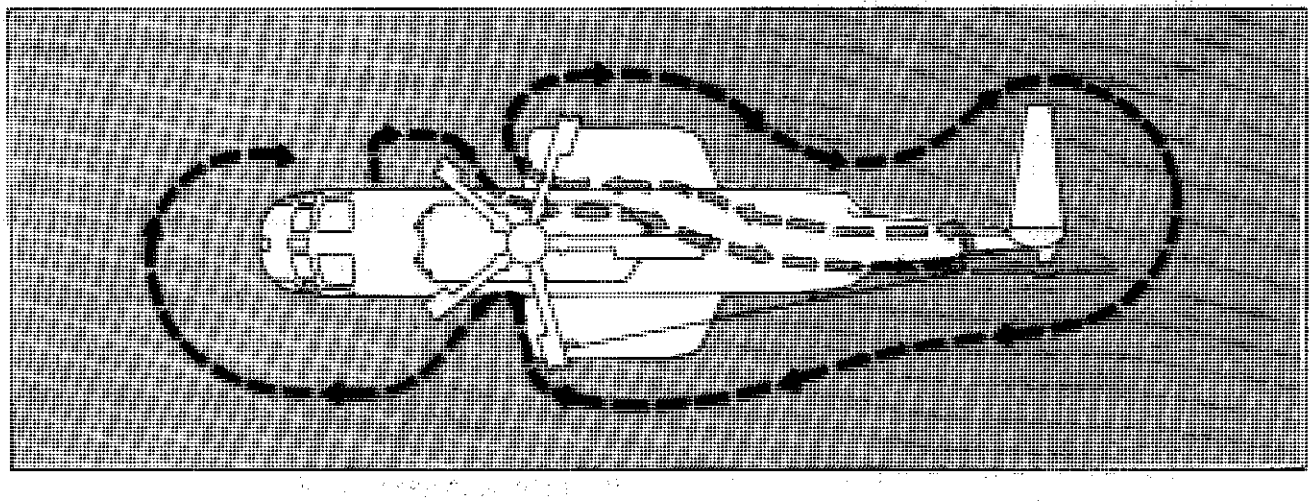


Figure 2-1. Exterior Inspection

*b. Tail pylon — CHECKED. Fairing for security and cracks.

6. Left rear fuselage.

*a. Intermediate gear box — CHECKED. Proper servicing, leaks and security.

b. Flare case — CHECKED. Loaded, securely mounted, and safety pin installed.

WARNING

Stay clear of area below loaded flare cases.

*c. Fire extinguisher thermal discharge disks — CHECKED. Ensure disks are not pushed out indicating a thermally discharged fire extinguisher.

7. Left sponson.

a. Sponson and auxiliary tanks — CHECKED.

Tank safety pin installed, secure, free of leaks and damage, fuel quantity checked, filler cap secured. Check release lever and electrical solenoid plunger for proper position (see figure 1-32).

b. Main gear and tires — CHECKED. Gear pin installed, free of leaks and damage.

c. Strobe light — CHECKED. For cracks and security.

*d. Removable cabin windows — CHECKED. Ensure windows are properly installed.

8. Upper left fuselage.

a. Engine oil level — CHECKED. Oil cap secured.

b. Engine inlet — CHECKED. Free of foreign matter and loose objects. Starter for security.

c. Engine — CHECKED. Free of leaks and general security.

d. Engine exhaust section — CHECKED. Evidence of cracks and FOD, tail pipe aligned.

e. Engine door — CHECKED. Latching mechanism for wear, door for proper closing and security. Door closed.

*f. Main gear box — CHECKED. Free of leaks and damage, proper oil level.

*g. Transmission deck — CHECKED. Free of leaks.

*h. Main rotor blades — CHECKED. Undamaged, pockets aligned, and IBIS indicators seated.

i. Main rotor head fairing — CHECKED. Undamaged and secure.

*j. Main rotor head reservoirs — CHECKED. Serviced and free of leaks.

k. Main rotor head assembly and control linkages — CHECKED. Properly aligned and undamaged.

l. Primary and auxiliary reservoirs — CHECKED. Proper fluid level. Access panels closed.

m. Fire extinguisher — CHECKED. Correct pressure, access door closed.

*n. Main rotor head fairing access panels — SECURED. Closed and free of damage.

*o. APU cowling — CHECKED. Loose or missing fasteners, security.

*p. Main transmission work platform — SECURED. Closed and free of damage.

q. Cargo Sling Assembly — CHECKED. Proper security, cable routing, electrical connections for security, and frayed wiring.

9. Left front fuselage.

a. Main fuel tank filler caps — SECURED. Access panels closed.

*b. Engine drain line sump — CHECKED. Drain prior to flight (as required).

*c. Removable hatch — SECURED.

d. Antennas — CHECKED. Secure, clean and undamaged.

e. Copilot's window emergency release handle — SECURED.

f. Covers, plugs and all tiedowns — REMOVED.

10. Front fuselage.

a. Nose gear and tires — CHECKED. Free of leaks and secure.

b. Electronics compartment — CHECKED. No FOD, water, hydraulic fluid equipment for security.

c. Battery door — SECURED. Closed, locked and free of damage. Search light assembly for broken/cracked bulb.

*d. Pilot's - copilot's and center windshields — CHECKED. Clean and undamaged.

e. Refueling probe — CHECKED. Secure and free of leaks.

INTERIOR INSPECTION.

1. Pilot compartment — CHECKED.

a. Landing gear handle — DOWN.

b. Fuel dump switches — OFF.

CAUTION

To preclude the possibility of fuel spillage, fuel dump switches must be off prior to energizing the electrical system.

c. All electrical switches — OFF.

d. Battery — ON (Voltage checked).

e. Inverter — ON.

f. Fuel quantity — CHECKED.

g. Fire warning — CHECKED.

h. All caution/advisory lights — CHECKED, CHECK CAUTION AND ADVISORY PANEL AND OPERATION OF ALL CAUTION LIGHTS.

i. Battery — OFF.

j. Emergency exit lights — CHECKED.

k. Emergency exit lights switch — RESET.

l. Circuit breakers — CHECKED.

m. First aid kit and fire extinguisher — CHECKED. (Secured and charged)

2. Forward Cargo Compartment — CHECKED.

a. Crash axe — SECURE.

b. Fuel indent plate — CHECKED.

c. Anchor, sea anchor, and anchor line — SECURED.

d. Cargo winch — CHECKED.

3. Aux Servo Compartment — CHECKED.

a. Servos — FREE OF HYDRAULIC LEAKS.

b. Filters — FREE OF LEAKS AND NOT IN BY-PASS.

c. Control rods — SAFETIED, ALIGNMENT, AND FREE OF DAMAGE.

4. Cargo/Personnel Door — CHECKED FOR OPERATION.

a. Emergency release handle — CHECKED AND SAFETIED.

b. Personnel door safety strap — CHECKED.

c. Rescue hoist and light — CHECKED (Secure and free of leaks)

5. Cargo Compartment

a. Removable hatch — SECURE AND SAFETIED.

b. Emergency exit lights — SECURE.

c. Hoist shear switch — SAFETIED.

d. ICS control panels — CHECKED AND SET (insure cords are secured and stowed).

CAUTION

Interphone cords must be routed clear of window emergency release handles to preclude inadvertent jettison of windows.

e. APU hand pump — CHECKED (secure, free of leaks, handle stowed, and accumulator serviced).

f. Cargo hook storage line — CHECKED (secure and condition).

g. Left and right removal cabin windows — SECURE AND JETTISON HANDLES ARE SAFETIED.

h. Tail rotor cables — CHECKED (condition, security).

i. Portable fire extinguisher — CHECKED (secure and charged).

j. Bilge pump — CHECKED.

NOTE

If overwater flight is anticipated, check bilge covers to insure they can be opened.

6. Forward and AFT ramps — CHECKED.

a. Ramp control panel — CHECKED, SECURED, AND PROPER SWITCH POSITION.

b. Forward ramp uplocks and actuating cylinders — FREE OF LEAKS AND UP LOCKS SAFETIED.

c. AFT ramp cylinders — CHECKED FREE OF LEAKS.

d. Cables checked — CONDITION AND SECURE.

BEFORE STARTING ENGINES.

The Before Starting Engines procedures in this section are for normal engine starting and rotor engagement which require use of the APU. Should the APU be inoperative, engine starts may be accomplished by use of ac or dc external power or the battery. For starting procedures other than by use of the APU, refer to Starting and Rotor Engagement Procedures With APU Inoperative in Section VII and/or Section IX.

*1. Passenger and crew briefing — "COMPLETED" (P)

Refer to Section VIII for Crew Briefing, Passenger Briefing, Predeparture Briefing, and Over Water Briefing.

*2. Flight stations — "CHECKED" (P, CP, FE)

a. Safety belt and shoulder harness — FASTENED (P, CP)

(1) Check that inertia reel lock will lock and unlock.

NOTE

When adjusting the shoulder harness, tighten the straps only enough to make a snug fit. Pulling the straps until they are tight against the stop may prevent the inertia reel lock mechanism from operating properly.

b. Seats — ADJUSTED (P, CP)

c. Tail rotor pedals — ADJUSTED (P, CP)

NOTE

Adjust tail rotor pedals with feet off pedals to avoid damage or breakage to the pedal adjustment cables.

d. Window emergency release — CHECKED (P, CP)

e. Pilot's console — SET. (P)

(1) J-4 compass selector switch — MAG.

(2) AFCS channel monitor panel. Channel disengage switches — ON. Hardover switches — CENTERED. Gyro select switch — LEFT.

(3) Public address and loudhailer systems — OFF.

(4) Battery bus circuit breakers — SET.

(5) Ramp control switches — OFF.

f. Altimeter — SET (P, CP)

g. Turn rate switches — NORMAL (P, CP)

h. Nosewheel — UNLOCKED (P)

CAUTION

The nosewheel lock handle must be unlocked for ground taxi (except rearward taxi), towing, takeoff and landing to prevent shearing the nose gear lock pin. During slope operations, the nosewheel lock handle should be locked to prevent the nose gear turning; however, caution must be used to avoid sideward motion as the helicopter settles to the ground.

i. Hoist and servo switches — SET (P, CP)

(1) Servo switches — CENTERED.

(2) Hoist master switch — OFF.

j. ICS panel — SET (P, CP, FE)

k. Circuit breakers — CHECKED (P, CP, FE)

3. Cockpit console — "SET." (CP/FE)

a. Alternate gear and external fuel tank release handle — DOWN AND SAFETIED.

b. Radios — OFF.

NOTE

If external power is used to start APU, UHF, and/or VHF radios may be turned on at this time. All other radios and navigation equipment should be OFF.

c. Ramp control switches — OFF.

d. External auxiliary fuel panel

(1) Jettison switches — OFF AND SAFETIED.

(2) Pressurization switches — OFF.

e. APU master switch — OFF.

f. APU fuel shutoff switch — NORMAL.

g. APU fire extinguisher switch — OFF.

h. Landing, search, and floodlight switches — OFF.

*4. Overhead control panel — "SET" (CP/FE)

a. Engine anti-ice switches — OFF.

b. Windshield anti-ice switch — OFF.

CAUTION

Failure to have the windshield anti-ice switches off prior to applying electrical power to the aircraft may cause the windshield to blister.

c. Windshield washer motor switch — OFF.
d. Anchor lights — OFF.
e. Fuselage lights — OFF.
f. Anti-collision light switches — AS REQUIRED.
g. Position lights — BRIGHT — FLASH.
h. Emergency exit lights — NORMAL.
i. Loading lights switch — OFF.
j. Rescue light — OFF.
k. Windshield wiper control knob — OFF.
l. Pitot heater switch — OFF.
m. Heater switch — OFF.
n. Vent fan switch — NORM.
o. Cockpit lights — AS REQUIRED.
p. Nose gear switch — AS REQUIRED.
q. Hoist master switch — OFF.
r. Cargo hook switch — SAFE.
s. Stick trim master switch — ON.
t. Inverter switch — ON.
u. Transformer rectifier switches — ON.
v. External power switch — AS REQUIRED.

NOTE

With ac or dc external power source connected and energized, turning on the external power switch should illuminate the external power on advisory light and energize the appropriate ac or dc circuits. Not all ac APUs are equipped to provide a 28-volt dc input. When using this type APU, it is necessary to activate the battery switch momentarily to provide dc current for energizing the ac external power relay.

w. Battery switch — ON (OFF if external power is used).
x. Crew alarm bell — CHECKED.
y. T-handles — IN.
z. Fire extinguisher switch — OFF.
aa. Hoist cable shear switch — OFF AND SAFETIED.
ab. Ignition switches — OFF.

5. Engine controls — "CHECKED." (P/CP)

a. Throttles — Check for freedom of movement, ground idle detent, full range, and shutoff.

b. Emergency fuel control levers — Check closed position stops, freedom of movement, full range, and closed (behind stops).

CAUTION

Failure to have emergency fuel control levers closed prior to start will result in a hot start.

*6. Rotor brake — "LOCK-OFF, BRAKE-ON." (P)

Minimum rotor brake pressure is 320 psi.

7. Pressure refuel panel — "SET." (CP)

a. Master power switch — OFF.

b. Probe selector switch — STOW.

c. Panel lamp test switch — PRESS TO TEST.

d. Main tank selector switches — SELECT (FWD AND AFT).

e. External auxiliary fuel tank selector switches — OFF.

f. Probe light rheostat — OFF.

g. Fuel dump switches — OFF.

*8. Fuel management system — "SET." (CP)

a. Fuel shutoff valve switches — CLOSE.

b. Fuel crossfeed valve switch — CLOSE.

c. Boost pump switches — AS REQUIRED (NO. 1 AFT BOOST PUMP SWITCH — ON).

NOTE

This pump assures fuel to the APU after the prime pump drops out, provided the ac essential bus is energized.

d. Fuel quantity indicators — CHECKED. Depress test switches and hold until pointers drop to below zero. After a drop to below zero has been noted, release test switches; pointers should return to their original reading.

WARNING

When the test switches are depressed and held and a pointer does not drop below zero, or the movement of a pointer is not smooth, a malfunction is indicated. When test switches are released below zero, a slight hesitation in the fuel quantity indicator may occur.

*9. Caution - advisory lights — "CHECKED." (P) Check that appropriate caution lights are on as noted below:

a. Check chip detector and ramp caution lights — PRESS TO TEST.

*b. With battery switch ON, 9 lights (if cargo door closed):

Nos. 1 and 2 generators.
Nos. 1 and 2 transformer-rectifier (TRs).
Transmission oil pressure.
Primary servo pressure.
Auxiliary servo pressure.
Blade pressure.
Rotor brake on.

NOTE

If the IBIS, BLADE PRESS caution light does not illuminate when the battery is ON, the IBIS circuit electrical continuity is defective.

c. With dc external power connected, the same nine lights on the caution panel will be illuminated.

d. With ac external power connected the two TR lights and the blade pressure light will not be illuminated.

NOTE

If any other lights are on at this time, the cause or condition should be noted or corrected before proceeding further.

*e. Check that all lights go on when press-to-test button is pressed.

*f. Reset master caution light as necessary.

NOTE

Crosscheck caution or advisory system and other cockpit indications as other systems are operated. This will help the pilot avoid reliance on a malfunctioning warning system and help prevent situations which can lead to incidents or equipment failure.

*10. Intercom — "CHECKED." (ALL)

*11. Fire warning system — "CHECKED." (P, CP)

a. All engine and APU warning lights illuminated.

b. Audible signal and cutout switches checked. Check pilot and copilot cutout switches.

*12. APU — "CLEAR." (FE/FIREGUARD), "STARTING." (CP/FE)

If APU is inoperative, refer to Engine Starting and Rotor Engagement Procedure With APU Inoperative in Section VII and/or Section IX.

a. APU caution lights — PRESS-TO-TEST.

b. APU master switch — RUN (High exhaust temperature light — ON, overspeed light — ON).

c. APU master switch — START (Hold until approximately 40% speed).

d. All APU caution lights — OFF.

NOTE

Continuous illumination of the pri- pump pressure caution light during the first 10 seconds of the starting cycle may indicate a failure of the APU prime pump or the prime fuel pressure switch. If it is determined that the prime pump is inoperative, corrective action should be taken before departing for a destination where ac ground power equipment is not available.

e. APU ON advisory light — ON.

NOTE

Lite-off should occur by 36% speed. Clutch engagement should occur at 76-80% speed at which time the accelerations will slow down for about 3 seconds, then rapidly speed up to 100% with a maximum momentary overshoot to 110%. Should engagement occur above 80% speed, the actual engagement speed will be entered in the Form 781. Total time for starts should be 9 to 12 seconds. Below $-29^{\circ}C$ total starting time should be a maximum of 18 seconds.

f. APU tachometer — 98 to 100%.

CAUTION

APU start should be aborted by moving the master switch to OFF position if any of the following occurs:

(1) APU tachometer hangs up between 76-80% for more than 4 seconds (6 seconds when below $-29^{\circ}C$). Overheating of clutch may result.

(2) No tachometer indication. This may signify a lack of overspeed protection or sensing of 90% which could result in ignition remaining energized and burning out.

(3) Low oil pressure caution light ON, high exhaust temperature caution light ON, or overspeed caution light ON. These indications should be accompanied by automatic shutdown.

NOTE

For APU Emergency Shutdown Procedures, refer to FIRE IN APU in Section III.

13. Generator switches — "ON" (CP/FE)

*14. Caution and advisory lights — "CHECKED," (P)
When the APU is running, eight caution lights (generators, transformer rectifiers, primary and auxiliary servo pressure, blade pressure and transmission oil pressure) should go off.

*15. Transmission and hydraulic indicators — "CHECKED." (P)
All indicators within normal range.

16. External power — "AS REQUIRED." (CP/FE)

a. Battery switch — ON.

b. External power switch — OFF.

c. External power — DISCONNECTED.
If APU is inoperative, refer to Starting and Rotor Engagement Procedures With APU Inoperative in Section VII and/or Section IX.

*17. Comm/Nav/Radios — "SET" (P, CP).

a. Radios on and set to desired frequencies.

b. IFF — STANDBY.

CAUTION

Do not turn on the doppler navigation equipment until after the engines are started as damage to the doppler power supply may result from the changes in electrical power when the engine starter is engaged and when the starter drops out. To avoid damage to the power supply within the doppler, both ac and dc current must remain stable and uninterrupted whenever the doppler switch is not OFF.

18. Cargo Sling Releases

If sling operations are planned refer to cargo sling procedures in Section VIII.

WARNING

Operation of the cargo emergency release should be smooth with no binding and the pedal should return to the full up position. If the pedal does not return to the full up position, a positive latching of the hook is not assured.

19. Rescue hoist — "CHECKED AS REQUIRED." (FE)

If hoist operations are anticipated.

*20. Ramp — "AS REQUIRED, CABLE ATTACHED." (FE)

CAUTION

To prevent possible damage to the ramp, do not extend nose gear or engage the rotors if the ramp is below the horizontal position.

*21. Lights — "CHECKED" FE/FIREGUARD "SET" (CP/FE)

NOTE

Visually check exterior lighting. Cockpit and loading lights should be checked as mission requires. Set position lights to flash when operated without anti-collision lights.

WARNING

- When checking strobe lights for operation, do not look directly at strobe light. An eye hazard exists and eye damage may occur. Strobe lights should be checked for operation and then turned off.

- Operation of anti-collision strobe lights during certain phases of operation (ground operation, hover, taxi, hoist operation, cargo sling, etc.) may cause hazardous distraction to personnel and the possibility of temporary vision blind spots. Anti-collision strobe lights (upper, lower, or both) should be turned off during these operations unless required.

*22. J-4 Compass — "SLAVED AND ALIGNED" (P) "ALIGNED" (CP)

a. Selector switch to MAG, annunciator needle centered, latitude set.

b. Heading indicators checked against standby compass. The maximum allowable difference between the heading indicators and the standby compass is seven degrees. The heading indicators have an allowed tolerance of two degrees from a known heading. There should be no difference between indications on the pilot's and copilot's heading indicators. The standby compass has an allowed tolerance of five degrees from a known heading. Refer to the compass correction cards for heading system corrections.

23. Voltmeter selector — "CHECKED." (CP)

NOTE

All positions shall read 28 ± 1 vdc.

*24. Landing gear and warning light — "CHECKED" (CP)

25. Flight controls and cyclic trim — "CHECKED" (P, FE/FIREGUARD)

a. Cyclic stick, collective pitch lever, and tail rotor pedals — CHECKED. Check for proper response and freedom of movement through full travel. Verify tail rotor star assembly is in when pilot says left pedal in and tail rotor star assembly is out when pilot says right pedal in.

b. When cyclic stick is displaced and released, it should return to original position.

c. Cyclic trim release button — CHECKED. With cyclic trim release button depressed, displace cyclic stick. When button is released, cyclic stick should remain in position set.

d. Cyclic trim switch — CHECKED. Move cyclic stick in each direction by use of trim switch.

e. Collective friction — AS REQUIRED. Friction may be checked at the pilot's discretion and after maintenance has been performed. Check that with full increase friction it is still possible to move the collective with normal arm force. Readjust collective friction to preclude collective bounce.

CAUTION

Any resistance or seizing of controls or excessive pedal force during these checks indicates a malfunction. The helicopter will not be flown until the discrepancy is corrected.

26. Primary servo — "OFF." (CP) "CHECKED, INTERLOCK CHECKED." (P)

NOTE

This check should be accomplished using the copilot's servo switch and the pilot's controls.

a. Check all flight controls for proper operation on auxiliary servos. Primary pressure should show zero and PRI PRESS caution light should come on. There should be no jump in the flight controls.

b. The pilot should check the servo interlock by placing his servo switch in the AUX OFF position and observing that there is no drop in the auxiliary servo hydraulic pressure and no caution light indication. As soon as this is ascertained, the pilot centers his servo switch.

27. Auxiliary servo — "OFF." (CP) "CHECKED, INTERLOCK CHECKED." (P)

NOTE

This check should be accomplished using the copilot's servo switch and the pilot's controls.

a. Check all flight controls for operation on primary servos. Auxiliary pressure should show zero and AUX PRESS caution light should come on.

WARNING

When turning auxiliary servo off, note that stick jump does not exceed 1/8 inch in cyclic and 1/16 inch in the tail rotor pedals and collective pitch to insure proper rigging of auxiliary servo pilot valve. Collective should be at least 4 inches from minimum during this check and tail rotor pedals in the neutral position. Excessive stick jump during this check indicates maladjustment or malfunction of the servo pilot valve. Normal AFCS inputs when combined with pilot valve error can result in auxiliary servo hardover.

b. The pilot should check the servo interlock by placing the servo switch in the PRI OFF position and observing that there is no drop in the primary servo hydraulic pressure and no caution light indication. As soon as this is ascertained, the pilot centers the servo switch.

28. Servo switches — "CENTERED." (CP) "PRI, AUX CENTERED." (P)

Pilot checks his servo switch in PRI and AUX position. Observe that caution lights illuminate and pressures drop as appropriate

and that pressures are normal and caution lights are off with both servo switches centered.

29. Parking brakes — "RESET" (P)

*30. "Before Starting Engines checklist completed." (CP/FE)

ENGINE STARTING AND ROTOR ENGAGEMENT.

Prior to engine start and rotor engagement, a designated crewmember or ground personnel should be positioned in front of the helicopter to preclude personnel from inadvertently trespassing into danger areas. Refer to figure 2-2.

1. Ignition switches — "NORMAL" (CP)

2. Fuel management system — "CHECKED AND SET." (CP)

   a. Fuel low pressure caution lights — CHECKED.
   Press to test.

   b. Fuel shutoff valves — OPEN.

   c. Fuel crossfeed valve — CHECKED AND CLOSED.
   Open the crossfeed valve. The No. 1 engine fuel flow should increase momentarily. Crossfeed valve closed.

NOTE

Check fuel shutoff and crossfeed valve status lights for proper indication when switches are actuated. Lights should illuminate briefly as valve moves.

   d. Boost pumps — CHECKED AND ON.

      (1) Turn on the FWD NO. 1 boost pump. The boost pump failure warning light should flicker, then go off and the engine fuel flow should increase momentarily. Turn off the boost pump.

      (2) Continue check of boost pumps. Failure warning light on momentarily, then off. Turn off the boost pump.

      (3) One boost pump on in each tank.

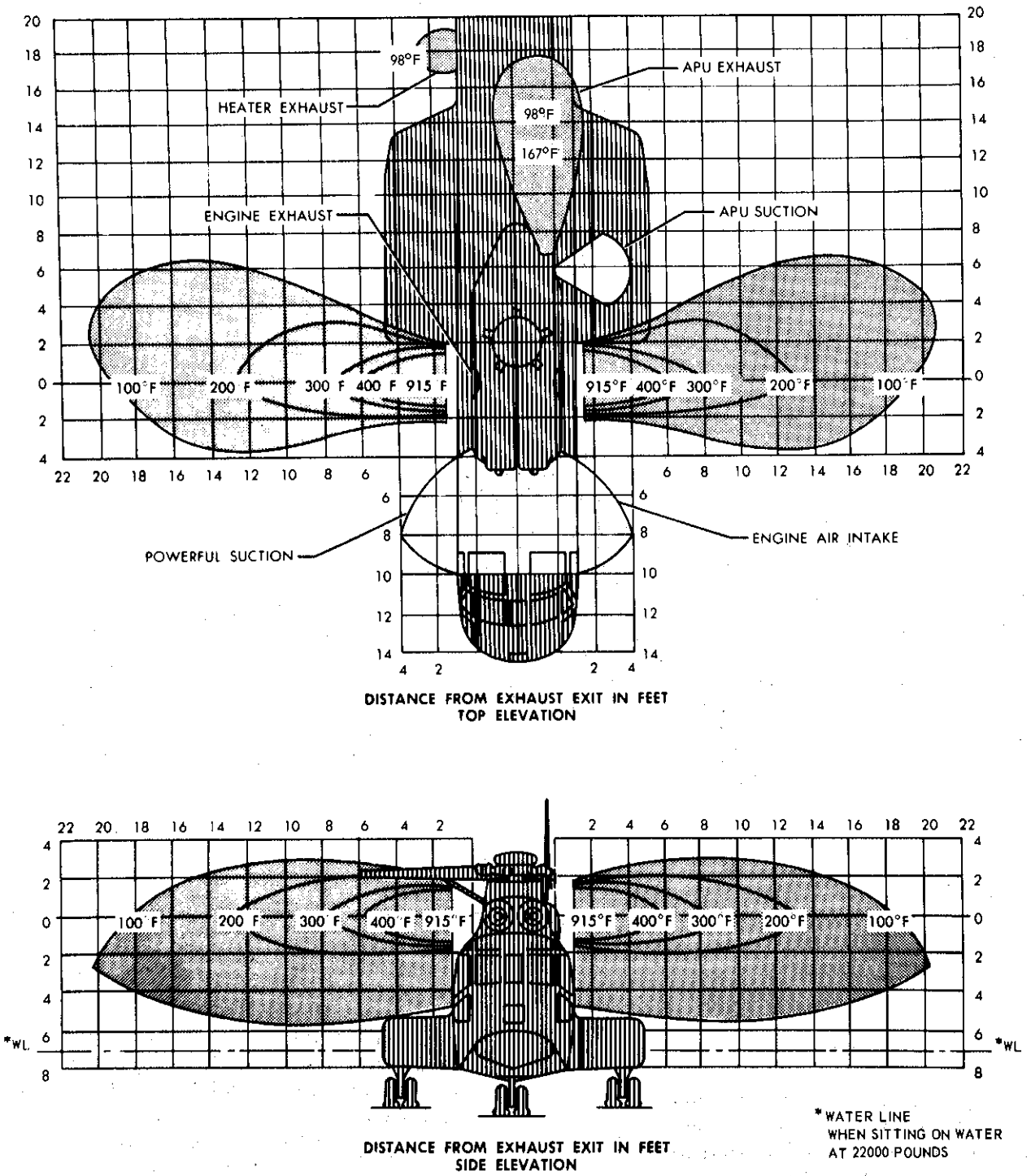


Figure 2-2. Danger Areas (Sheet 1 of 2)

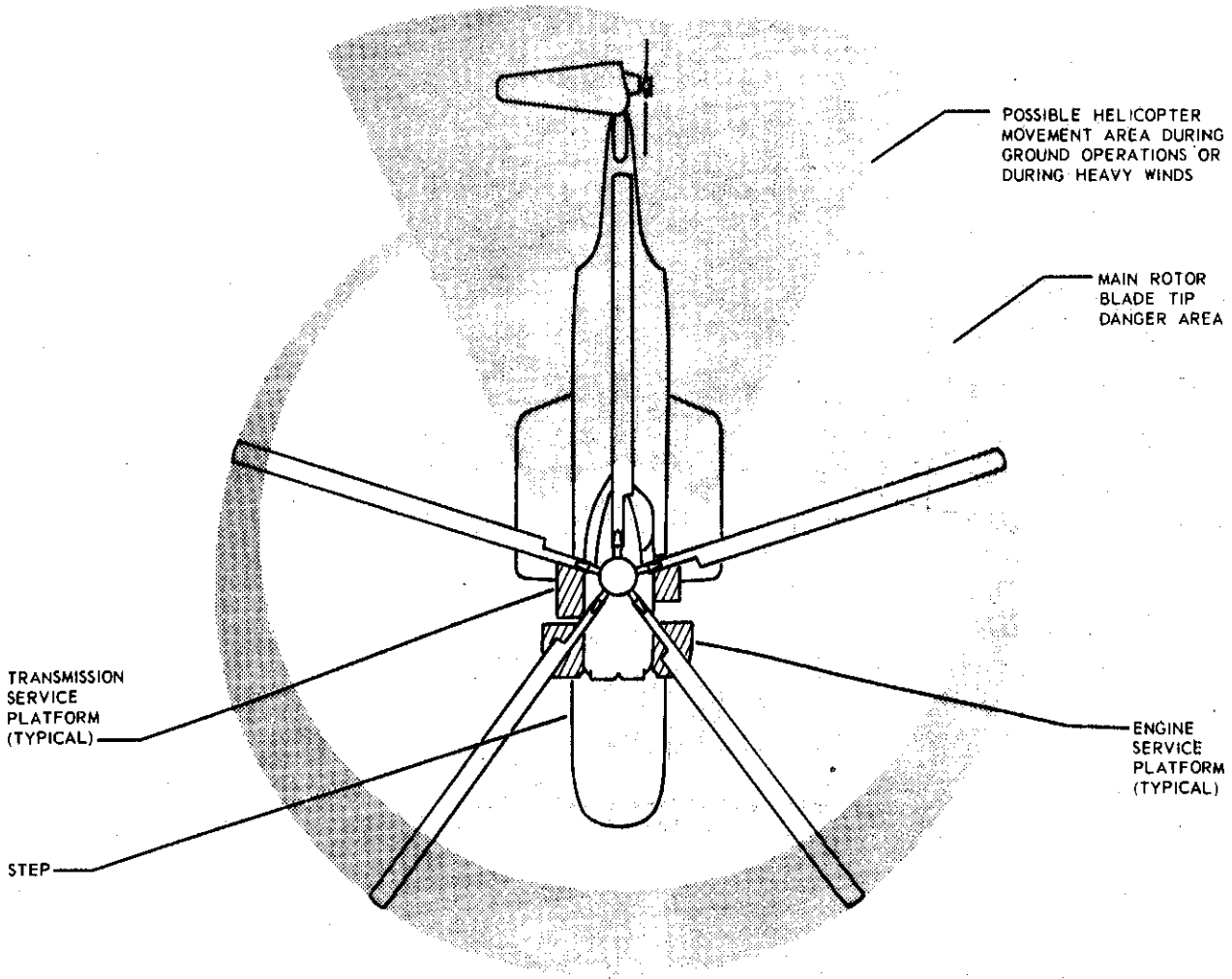


Figure 2-2. Danger Areas (Sheet 2 of 2)

NOTE

- If fuel system maintenance has been performed, leave boost pumps on for approximately one minute after start to purge trapped air from fuel lines.

- Continuous use of one boost pump per engine is recommended to prevent inadvertent operation without boost pumps when their use is required. Refer to EQUIPMENT LIMITATIONS in Section V when the use of boost pumps is required. A recommended procedure for the operation of boost pumps is that the outside switches (No. 1 FWD and No. 2 AFT) be operated on odd dates and the inside switches on even dates. This procedure will equalize boost pump usage and will assure at least one boost pump is on if one generator should fail. If the fuel system is not primed, it may be required to turn the boost pumps ON for 20 to 30 seconds to prime before starting. An exception to the normal boost pump procedures (i.e., one per tank) may be made when two pumps are operative in one fuel tank and the mission can be completed using only fuel from that tank.

3. No. 1 engine — "CLEAR."(FE/FIRE-GUARD)
"STARTING." (P/CP)

Either engine may be started first.

NOTE

If APU is inoperative, see Starting and Rotor Engagement Procedures With APU Inoperative in Section VII and/or Section IX.

CAUTION

To prevent damage to starter, do not operate starter continuously for more than 30 seconds except in an emergency. Do not attempt more than three starts in any 30 minute period. Allow three minutes cooling period between starter disengagement and starter reengagement.

a. Starter button — DEPRESS.
(Holding throttle in SHUTOFF position.) The magnetic compass should swing and both loadmeters drop to zero.

b. Throttle — GRD IDLE.
With a minimum of 19% N_g and T_5 below 100°C, move the throttle to GRD IDLE. On a normal start, peak T_5 may be reached within 3 seconds after lite-off and is often close to 750°C.

NOTE

If 19N_g is not obtained within 10 seconds after the starter is engaged, or if engine lite-off is not obtained within 20 seconds after the starter is engaged, abort the start. An engine start may be aborted any time after the starter and ignition system have been energized by pulling down on the throttle and returning it to the SHUTOFF position. Before attempting another start, wait 3 minutes for starter cooling and for fuel to drain from the manifold, combustion chamber and exhaust section.

CAUTION

When T_5 rises abnormally and/or reaches 840°C, abort the start and be alert for an engine fire. Determine the cause of the hot start before attempting a restart. Normally, only one restart should be attempted.

NOTE

When the gas generator (Ng) does not accelerate, monitor the power turbine inlet temperature (T_5). If temperatures remains low, abort the start or use starting procedures described in USE OF EMERGENCY FUEL CONTROL LEVER TO ASSIST STARTING in Section III.

c. Loadmeters — OBSERVE FOR STARTER DROPOUT.

Starter dropout should occur between 45 and 53% N_g.

CAUTION

If normal starter dropout indications are not observed, pull down on the throttle to abort starter operation, while leaving the throttle in the ground idle position. If starter does not disengage, pull the affected starter circuit breaker to prevent starter damage that will result at idle or higher N_g.

d. Engine instruments — CHECK.
After engine temperature and pressure have stabilized:

(1) Check for approximately 56 ± 3% N_g. (15°C OAT).

NOTE

Idle speeds are affected by ambient temperatures and can vary from 50 ± 3% N_g at -40°C OAT to 59 ± 3% N_g at 50°C.

(2) T_5 at approximately 300 to 525°C.

(3) At ground idle, fuel flow is approximately 165 pounds per hour.

(4) Engine oil pressure should be at approximately 8 to 19 psi.

CAUTION

- If a minimum of 8 psi engine oil pressure is not indicated, shut engine down.
- Slow acceleration during starter engagement or noticeable fluctuation of N_g and oil pressure when stabilized at ground idle may indicate impending failure of the engine accessory drive shaft and subsequent engine flameout, especially if engine oil samples indicate high iron content.

4. No. 2 engine — "CLEAR." (FE/FIREGUARD), "STARTING." (P/CP)

   The procedure for starting the No. 2 engine is the same as for the No. 1 engine.

5. External auxiliary fuel tanks — "CLEAR" (FE/FIREGUARD) "FLOW" (CP/FE) "CHECKED" (FE/FIREGUARD)

   Pressurize each tank and check that fuel is transferring with no fuel leakage. To ensure fuel transfer from the auxiliary fuel tanks and to check the main tank selector shutoff valves, proceed as follows:

   a. Fwd main tank selector switch — ON
   b. Turn right pressurization switch — ON
   c. Monitor refueling panel to ensure fwd main tank flow light illuminates.
   d. Aft main tank selector switch — ON
   e. Fwd main tank selector switch — OFF
   f. Monitor refueling panel to ensure fwd main tank flow light extinguishes and aft main tank flow light illuminates.
   g. Fwd main tank selector switch — ON
   h. Aft main tank selector switch — OFF
   i. Monitor refueling panel to ensure aft main tank flow light extinguishes.
   j. Turn right pressurization switch — OFF

   NOTE

   Either tank may be checked first. Forward and aft main tank selector switches need only to be checked once.

   Repeat procedure for opposite auxiliary fuel tank.

   k. Main tank selector switches — ON

6. Pins, chocks, and static wire — "REMOVED" (FE)/FIREGUARD

   NOTE

   The FE/FIREGUARD may remove pins and chocks during the external auxiliary fuel tanks inspection (step 5).

   WARNING

   AN/ALE-20 safety pins and landing gear lock pins will be removed prior to removing the wheel chocks and wheel chocks will be removed prior to removing the auxiliary fuel tank pins. A visual inspection will be performed of the MK8 bomb shackle and plunger prior to pulling the safety pin. After removal of the auxiliary fuel tank pins, all personnel should remain clear of the area. If APU is inoperative, pins and chocks will be removed after rotor engagement. If an unusual amount of force is required to remove any safety pin, the operation will be terminated and the discrepancy annotated in the AFTO Form 781 for maintenance inspection/action.

7. AFCS — "ON AND INDICATORS CHECKED" (P, CP)

   Check AFCS indicators in Mode A, no OFF flags visible, no hardover signals indicated, and CG trim centered. Move the cyclic stick in the fore-aft and left-right directions while checking both AFCS indicators for full-scale deflection and proper movement of the horizontal and vertical bars. Other channels may be checked at pilot's discretion.

c. Rotor brake — OFF (light out). Accelerate rotors smoothly to 100% N_r using approximately 40% torque. As N_r increases, ensure that N_f increases on both engines.

CAUTION

- If no N_f is observed, this may indicate a possible failure of the fuel control flex shaft. Return the throttle to the shutoff position and accomplish the engine shutdown checklist.
- A rapid acceleration of the engine during or after rotor brake release can cause an overtorque condition during rotor engagement.

d. Anti-flapping restrainers and droop stops — RELEASED.
Anti-flapping restrainers should release at approximately 25% rotor speed and droop stops should release at approximately 75% rotor speed.

e. Flight controls — CHECK RESPONSE.
As rotor speed accelerates, actuate the flight controls a slight amount in all directions and check for proper response.

CAUTION

If flight controls do not respond correctly, shut down by retarding both throttles to SHUTOFF and applying the rotor brake.

10. APU master switch — "OFF." (P/FE)

a. Place the APU master switch in the OFF position. As the APU speed decreases the APU advisory light will go off.

b. Caution-advisory panel — CHECKED.

WARNING

Illumination of the generator caution lights indicates a possible malfunction of the tail takeoff free wheel unit. Attempt to restart the APU. If APU restarts, continue with "Engine Shutdown" checklist. If APU will not restart, advance the No. 1 engine to maximum and proceed with "Shutdown With Tail Takeoff Free Wheel Unit Inoperative" checklist in Section III. Do not shut down the No. 1 engine until the rotor is stopped or the APU is started in order to maintain hydraulic servo pressure.

11. Unloaded engine throttle — "SET — 102%." (P) (Pilot's and copilot's triple tachometer gages should be within 2% N_f/N_r of each other.)

If an external power unit is used during engine start and rotor engagement, proceed as follows:

a. Battery switch — ON.

b. External power switch — OFF.

c. External power — DISCONNECT.

12. Refueling probe — "CHECKED AS REQUIRED" (CP, FE)

a. Probe will be checked if air refueling is anticipated.

NOTE

This check may be accomplished by observation from inside the helicopter to preclude any possible hazard associated with personnel working under turning rotors and/or the possibility of frost bite during cold weather operations.

b. Check probe for proper extension, security, gouges, trapped fuel and retraction.

WARNING

Ensure the area in front of the probe is clear before extending.

13. Boost pumps — "OFF." (CP)

NOTE

The boost pump off check is to ensure that no air leak exists in the fuel lines that would cause starvation of the engine-driven fuel pumps and subsequent flameout. The boost pumps should not be left off in excess of two minutes as prolonged operation with boost pumps off can cause engine flameouts under certain conditions.

14. "Engine Starting and Rotor Engagement checklist completed." (CP/FE)

BEFORE TAXIING.

1. Engine anti-ice caution and advisory lights — "AS REQUIRED" (CP/FE)

NOTE

Engine anti-ice check is not required if no possibility exists of flying in temperature below 10°C. If the power available check is more than 3 percent below computed power, the anti-ice check must be performed to confirm the status of the anti-ice valve.

a. Engine anti-ice switches — ON.

b. Engine anti-ice caution and advisory lights — ON.

2. Doppler — "STANDBY." (CP)

CAUTION

To prevent damage to the doppler antenna, the doppler should be placed in STBY rather than OFF during flights when the doppler is not used. With the doppler OFF, the antenna is not stabilized and will bounce against the stops possibly damaging the mounts and gimbals.

NOTE

Doppler function switch should be placed in STBY position at least one minute prior to takeoff for adequate warm up.

3. Alarm bell — "CHECKED." (CP/FE)

4. Engine and windshield anti-ice — "AS REQUIRED." (CP/FE)

a. Engine Anti-ice system — CHECKED. (CP/FE).
With collective set at minimum and aircraft headed into the wind, perform the following checks:

(1) Beep throttles to maximum and note T_5.

(2) Place No. 1 engine anti-ice switch OFF.

(3) T_5 should decrease approximately ten degrees.

(4) Return anti-ice switch to ON.

(5) Engine anti-ice advisory light should illuminate and T_5 should increase to the value noted in step (1) above.

(6) Repeat procedures for No. 2 engine.

NOTE

Engine anti-ice valves can only be verified open or closed by accomplishing the above anti-icing checks.

(7) Engine anti-ice caution lights OFF. (If anti-ice caution lights remain illuminated at this time due to lower ambient temperatures, ensure caution lights extinguish prior to takeoff.)

NOTE

If the OAT is extremely low (-18°C), the heating elements may not produce enough heat to raise the inlet duct temperature to 37.8°C to cause the caution lights to go off. However, at lower temperatures, where this may occur, icing conditions are not usually encountered due to lack of moisture in the air. Ensure that the anti-icing system is turned on before icing conditions are encountered. Icing may be expected when temperatures are 10°C or below with high relative humidity, visible moisture, flight in clouds, or in proximity of these phenomena.

b. Windshield anti-ice switches — AS REQUIRED.

CAUTION

The windshield anti-ice switches should be placed in the LOW position before going to the HIGH position to avoid the possibility of the glass cracking due to sudden change in temperatures. Normally, the use of the HIGH position is not required except at very low outside temperatures when ice cannot be removed by the LOW position.

5. Pitot heat — "CHECKED AS REQUIRED." (CP/FE)
Turn on pitot heat switch momentarily and observe loadmeter increase.

6. Engine acceleration-deceleration, flat pitch, and freewheeling — "AS REQUIRED." (P/CP)

The acceleration-deceleration, flat pitch, and freewheeling check will be performed on first flight of day or when engine deterioration is suspected.

CAUTION

Engage unloaded engine carefully, bringing that engine up slowly until it engages the transmission.

NOTE

- A maximum of 2% N_f overshoot is allowed. No transmission engagement noises should be heard.
- When making this check, the pilot should observe operation of both engines simultaneously for signs of acceleration or deceleration stall since the engine set to drive the rotor at 100% will experience a rapid deceleration while the engine being checked is accelerated.

Abnormal indications which might be anticipated are: loud bangs with no unusual instrument indications, loud bangs accompanied by decreasing N_g and increasing T_5, hissing sounds accompanied by decreasing N_g and increasing T_5.

NOTE

Beeper trim should always be used when maximum N_f is required. Slack cables will sometimes prevent maximum N_f from being obtained when using the throttles.

a. With collective pitch lever at minimum, advance No. 2 throttle and beep for maximum N_f. Retard No. 1 N_f to approximately 98% and check No. 2 N_f at 107 to 109%. Confirm freeweheeling by checking that No. 1 N_f is split from N_r.

b. With collective pitch at minimum, set N_f of No. 2 engine at 100%.

c. Carefully set No. 1 engine at 75% N_g.

d. Smoothly advance No. 1 engine throttle to full forward within 1 second.

e. When No. 1 engine max N_g is reached, rapidly retard the throttle to GND IDLE (being careful not to pass detent).

NOTE

For proper stator vane response, the N_g should accelerate from 75% to 90% in not more than 6 seconds. Timing will commence from 75% N_g and stop as N_g passes through 90%. If there are any abnormal indications or if time exceeds 6 seconds, the condition must be corrected prior to flight. N_g values over 90% may be encountered and are not considered abnormal. A reduction in opposite throttle from 100% N_f may be necessary to reach the above N_g values which are a function of engine load requirements.

f. Beep the No. 1 throttle for maximum N_f and repeat the check for No. 2 engine.

WARNING

Illumination of the generator caution lights indicates a possible malfunction of the tail takeoff freewheel unit. Advance the No. 1 engine to maximum and proceed with SHUTDOWN WITH TAIL TAKEOFF FREEWHEELING UNIT INOPERATIVE checklist in Section III. Do not shut down the No. 1 engine until the rotor is stopped or the APU is started in order to maintain hydraulic servo pressure.

CAUTION

Be alert for possible compressor stall on acceleration or deceleration which would be indicated by a rapid rise of T_5 and/or rumbling or explosive noises. If this occurs, shut down engine.

NOTE

Both engines should be accelerated and decelerated smoothly when advancing or retarding throttles.

7. Personnel door emergency release handle — "CHECKED" (FE)

   With door closed, check handle in closed position, locking plunger seated in flange detent and lock pins full seated in slide and door hanger pin groove.

8. Crew and passengers — "READY FOR TAXI." (FE)

   The flight engineer will ensure that all passengers, crewmembers, and cargo are secured for taxi. The cargo door and ramp will be as required.

WARNING

- The aft ramp cables must be attached and forward ramp locked prior to all flights. If the ramp should extend beyond the horizontal position in forward flight, the helicopter may assume an extreme nose down attitude.
- The personnel door safety strap shall be attached whenever the personnel door is open and the helicopter is in motion unless cabin occupants have seat belts fastened or are wearing safety harnesses.

NOTE

The cabin entrance ladder, pins and chocks, and intercom cord will be secured prior to taxi. Stow the cabin entrance ladder in accordance with TO 1H-3(C)C-9.

9. Safety belt, shoulder harness, and inertial reel lock — "FASTENED AND CHECKED" (FE).

10. Radio call — "COMPLETED." (P/CP)

11. Clocks and altimeters — "SET, STATE SETTING." (P, CP)

CAUTION

During normal use of the barometric setting knob, momentary locking of the counter drums may be experienced. If this occurs, do not force the setting knob. Application of force may cause internal gear disengagement and result in excessive altitude error. If locking occurs, the required setting may sometimes be established by rotating the knob a full turn in the opposite direction and approaching the setting again with caution.

12. Area — "CLEAR." (ALL)

13. Parking brake — "OFF." (P)

14. "Before Taxiing checklist completed." (CP/FE)

TAXIING.

Begin taxiing by increasing collective slightly. A small amount of forward cyclic may be necessary to assure forward motion is obtained. Rearward taxiing is accomplished, with nose gear locked, by raising the collective pitch and holding the cyclic aft, but not to the extent that it causes the blades to hit the droop stops. Caution should be observed when there are light planes within the immediate area as they may be upset by the turbulence caused by the rotors. If the rotor blades hit the droop stops while taxiing with the cyclic stick forward, adjust the cyclic and increase collective pitch slightly to lift the blades from the droop stops. Maximum N_r should be maintained when taxiing over rough terrain, in a strong crosswind, or whenever an immediate takeoff is anticipated. When taxiing crosswind, hold the cyclic stick slightly into the wind. Regulate taxi speed with collective pitch and wheel brakes. Regulate directional control using tail rotor pedals. When taxiing at high gross weights, maintain a small amount of up collective and move cyclic stick slightly in the direction of any turns to avoid excessive wear on the tires.

NOTE

Flight instruments and brakes will be checked during taxi.

BEFORE TAKEOFF.

1. Boost pumps — "ON." (CP), "CHECKED ON." (P)

WARNING

One boost pump must be on and operating in each tank to ensure continuous engine operation during any condition listed under Equipment Limitations, Section V.

2. Electronic altimeter — "ON." (P, CP)

3. Flight instruments — "CHECKED." (P, CP)

   Set attitude indicator, check turn and slip, heading, vertical velocity, and airspeed indicators.

4. Navigation equipment — "CHECKED AND SET." (P, CP/FE)

   Tune, identify and check TACAN, ADF, ILS, VOR, and DOPPLER, if required.

5. IFF — "AS REQUIRED." (P, CP)

**6. AFCS — "CHECKED ON" (P)

**7. Engine and transmission instruments — "CHECKED." (CP)

**8. Caution and advisory lights — "CHECKED." (P)

   Check all caution and advisory lights and reset master caution light.

**9. Passengers and crew — "BRIEFED AND READY FOR TAKEOFF" (P)

   Pilot will review performance data and brief on takeoff procedures. Ensure cabin occupants are ready for takeoff.

**10. Parking brake — "OFF." (P)

**11. Throttles — "MAXIMUM" (P)

   A lower rpm setting may be used at the pilot's discretion.

WARNING

Do not allow N_r to droop below 100% as main and tail rotor effectiveness will be reduced.

**12. Lights — "SET" (CP/FE)

   The strobe lights should be turned on to the both position and white position for day and red for night. The position lights will be turned to steady position.

13. Electronic altimeter — "CHECKED." (P, CP)
   Depress PUSH-TO-TEST knob; pointer should indicate 100 ± 15 feet.

14. Hover check — "COMPLETED." (P)

a. Power required to hover. Except when unable to hover, power required to hover should be checked and compared with that computed on the TOLD card. If actual power required to hover differs significantly from computed, evaluate the governing parameters (actual OAT, pressure altitude, and aircraft weight) to determine if they caused the difference or if an error was made in computation and if the difference warrants refiguring the TOLD card.

NOTE

At maximum N_f the allowable steady state torque split is 10%.

b. Maximum power available. Check maximum power available in accordance with Section VII prior to: (1) The first flight of the day and (2) operation at or near the maximum capability of the helicopter.

c. Topping adjustment. Accomplish topping adjustment in accordance with Section VII when required as a result of the maximum power available check.

d. N_g/T_5 relationship check. Accomplish in accordance with Section VII, Before Salt Water Operations, or whenever compressor deterioration is suspected. This check may be delayed and performed in cruise flight.

**15. "Before Takeoff checklist — COMPLETED." (CP/FE)

TAKEOFF.

Factors which will determine the type of takeoff to be performed are: gross weight of the aircraft, meteorological conditions, characteristics and obstacles associated with takeoff area, and the tactical situation. The first objective during takeoff is to clear obstacles at a safe airspeed and then establish the airspeed which will result in the best rate-of-climb reflected in appropriate climb charts in the Appendix. This is also the airspeed that will produce best single engine performance. The appropriate takeoff charts in the Appendix show the factors necessary to clear a 50-foot obstacle. The appropriate height velocity diagrams in the Appendix should be used as a guide in determining takeoff climb speeds. There are many possible variations for takeoff, but the most commonly used are: takeoff to a hover, normal takeoff, maximum performance takeoff, and the running takeoff. Operational necessity may require a combination of these takeoffs.

During normal takeoffs and landings with the helicopter light on the gear, bank angle, sidedrift, or crosswind 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 is 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 as little as five degrees, coupled with roll rates and crosswinds, can cause the helicopter to roll over in approximately two seconds.

WARNING

When performing normal takeoffs and landings, the pilot must maintain precise control of roll attitudes so as not to allow the helicopter 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. To understand the full aspects of this phenomenon, refer to Section IV.

CAUTION

The helicopter may have a tendency to leave the ground in a slightly nosedown attitude. Care should be exercised to avoid striking the nosewheel or air refueling probe (if installed) on the ground.

NOTE

A safe single engine airspeed of 70-80 KIAS should be attained as soon as practical after takeoff.

TAKEOFF TO A HOVER.
(Refer to figure 2-5.)

The takeoff to a hover is used to facilitate engine and flight control systems checks, for hover taxiing, and is used in conjunction with other takeoffs. To accomplish, increase collective pitch to establish the desired hover altitude. Maintain the desired heading with tail rotor pedals and aircraft position with the cyclic stick. When a stable hover is established, check the engine performance as required, flight controls, and CG trim before continuing flight.

TAKEOFF FROM A HOVER.
(Refer to figure 2-5.)

Initiate forward flight with cyclic control and adjust collective pitch lever for desired performance and terrain clearance. After obtaining translational lift, climb by increasing airspeed and altitude simultaneously. After obtaining climb airspeed, establish the desired rate of climb.

TAKEOFF WITHOUT HOVER.
(Refer to figure 2-6.)

The takeoff without a hover is accomplished by steadily increasing collective until a definite climb is established. As the aircraft leaves the ground and adequate terrain clearance is obtained, forward cyclic is applied and the nose lowered to allow the aircraft to accelerate and climb simultaneously. The aircraft should be accelerated to climb speed as soon as practical after clearing obstacles.

MAXIMUM PERFORMANCE TAKEOFF.
(Refer to figure 2-7.)

The maximum performance takeoff may be required when operating from small and/or restricted areas. Under extreme conditions, sufficient power to hover out of ground effect may be required to perform this type takeoff. With throttles set at maximum N_r, increase collective pitch smoothly to maximum power. Simultaneously increase airspeed to the extent consistent with safely clearing the obstacles until climb airspeed can be attained.

CAUTION

Minimize operating time in the AVOID CONTINUOUS OPERATION area of the Height-Velocity Diagrams in the Appendix.

NOTE

- Under critical operational conditions, it may be necessary to parallel the ground at near hover altitude while accelerating to best climb speed.
- Vertical takeoffs and climb to out-of-ground-effect altitude are not normally required; however, if operational requirements dictate, accelerate to climb airspeed as soon as possible after clearing obstacles.

RUNNING TAKEOFF.
(Refer to figure 2-8.)

When sufficient power to accomplish a normal takeoff is not available, it may be possible to perform a running takeoff. Accomplish by heading the helicopter into the wind, if practical, and adjust the throttles to maximum N_r. Increase collective pitch and apply cyclic control as necessary to obtain takeoff speed. (See appropriate takeoff charts in the Appendix.) The aircraft will normally fly off the surface; however, some aft cyclic may be necessary. During takeoff, apply power to continue acceleration to climb airspeed and maintain directional control with tail rotor pedals throughout the maneuver. To practice running takeoffs,

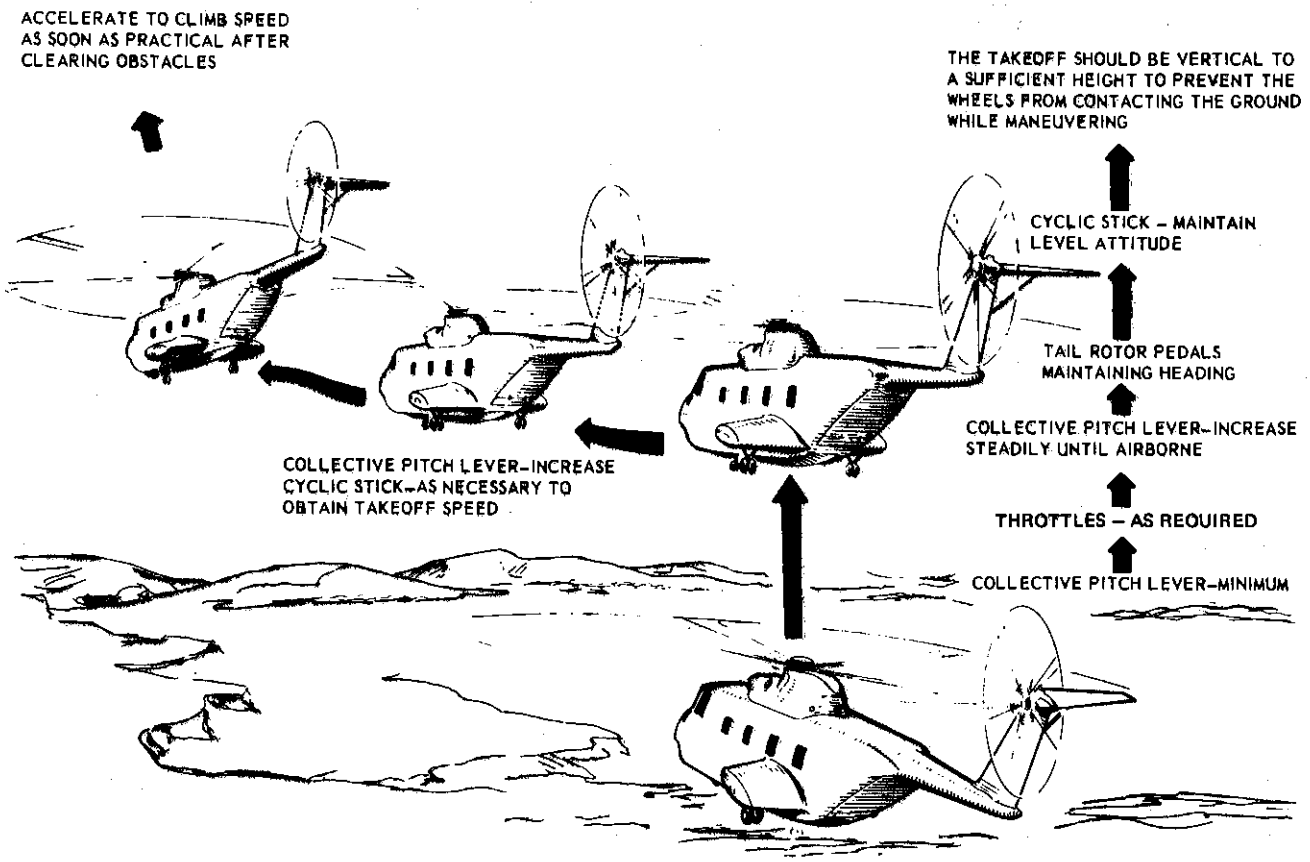


Figure 2-5. Normal Takeoff (Typical)

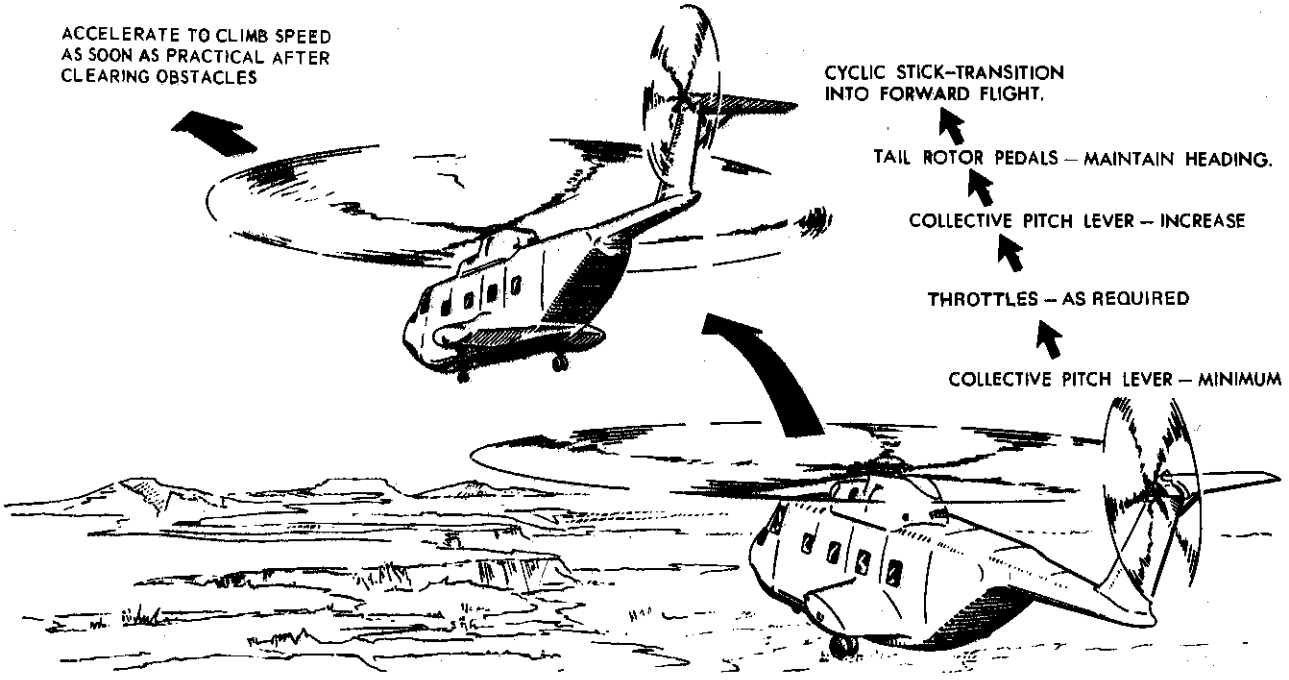


Figure 2-6. Takeoff Without a Hover (Typical)

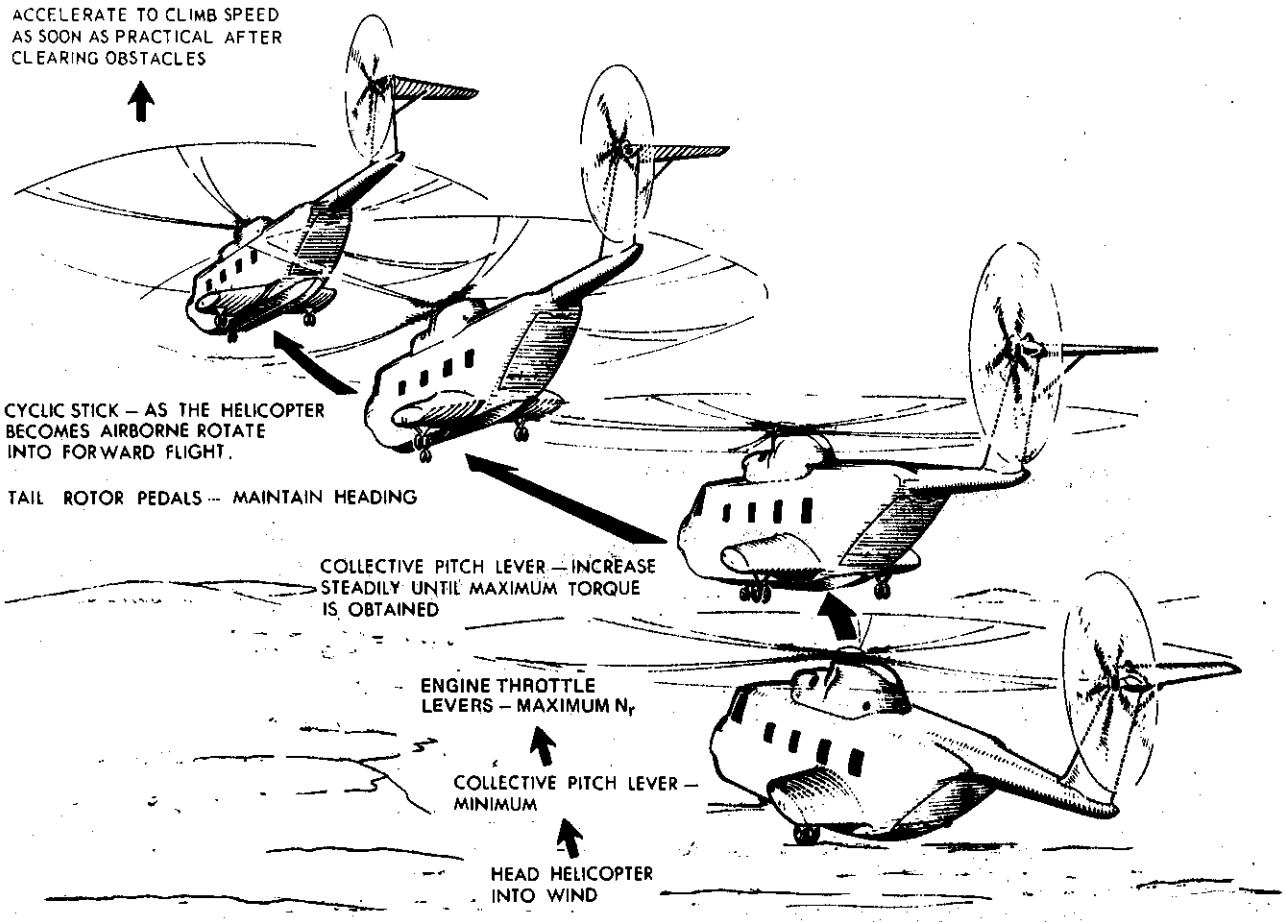


Figure 2-7. Maximum Performance Takeoff (Typical)

use approximately 10% torque less than required to hover at 5 feet wheel clearance.

CAUTION

Running takeoffs should not be attempted over rough or rocky terrain due to the possibility of damage to the helicopter.

AFTER TAKEOFF.

As the helicopter accelerates from hovering to forward flight, it enters translational lift. If engine power, rotor rpm, and collective pitch remain constant and the cyclic stick is moved forward to tilt the tip-path plane of the rotor to obtain forward speed, a momentary settling will be noted. As the helicopter accelerates forward, less power is required due to the large air mass contacted by the rotor in forward flight. As forward speed increases, the helicopter will begin to climb. Maintain approximately 70-80 knots and monitor all instruments. Refer to the climb data in Appendix for best climb speeds. The pilot initiates this check by stating "Landing gear (as required), After Takeoff checklist." The copilot responds, "Landing gear (as required)" and positions the gear handle. The (CP/FE) silently completes 1 through 6, calling out item 7.

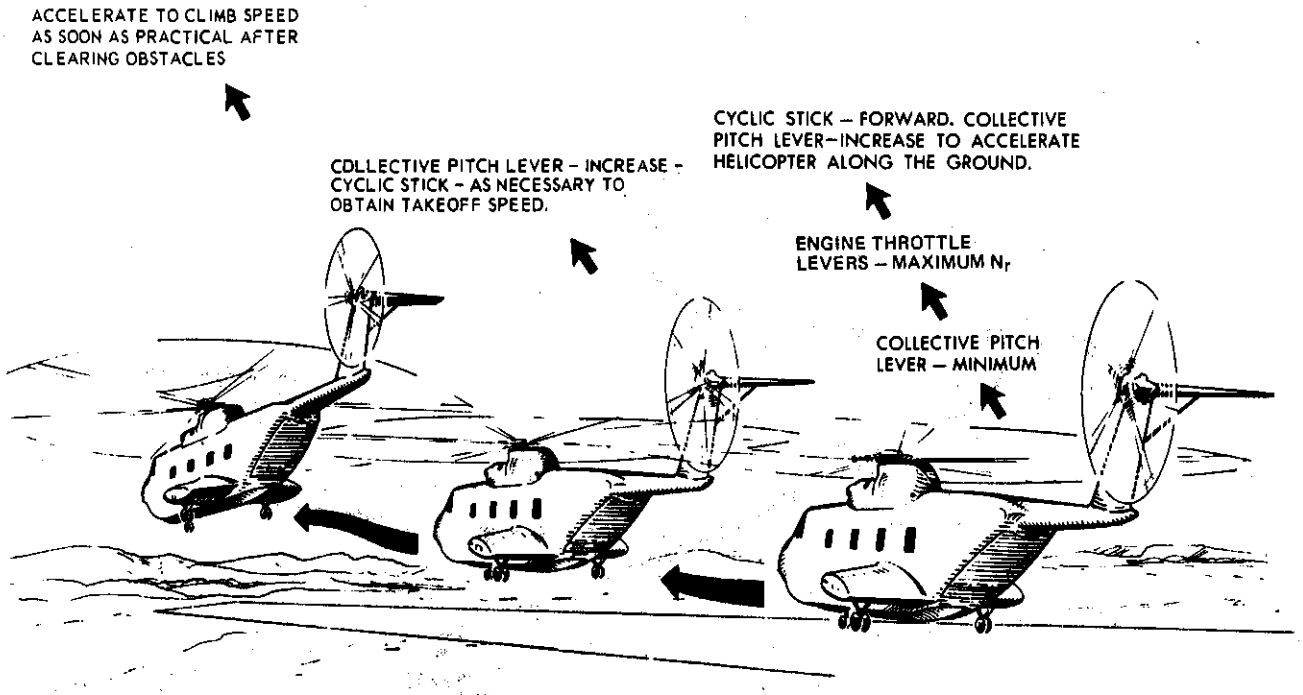


Figure 2-8. Running Takeoff (Typical)

NOTE

There are no structural limitations, based on airspeed, for extension or retraction of the gear. The landing gear should be down and locked at all times when over land below 100 feet or below a minimum safe single engine airspeed of 70 KIAS. Helicopters engaged in a mission which may be compromised by having the gear down (e.g., mid-air recovery (MARS), etc.) may deviate from the 70-knot airspeed requirements during performance of the mission. If desired, the electronic altimeter may be set to serve as a reminder to extend or retract the landing gear.

1. Engine and transmission instruments — CHECKED. (CP/FE)
2. Lights — SET. (CP/FE)
3. Landing gear — INDICATORS CHECKED. (CP/FE)
4. Throttles — ADJUSTED. (CP/FE)
5. AN/ALE-20 arming switch — ON (ARMED) (CP/FE)
6. Visual Aircraft Inspection — COMPLETED (FE)

NOTE

The flight engineer will check the aircraft interior for fuel, oil, and hydraulic leaks, cabin windows security and general aircraft condition as soon as practical after initial takeoff. This check will be repeated periodically during flight.

7. "After Takeoff Checklist completed." (CP/FE)

CRUISE.

Refer to Appendix, as necessary to determine best cruise airspeeds. After cruise airspeed has been established, adjust rotor speed between 100 and 103% to that speed which produces the smoothest

flight, or which will give the desired performance. Readjust pitch, as necessary, to maintain the desired airspeed. The smoothest rotor speed in forward flight may vary, depending on the vibration characteristics of each helicopter at various gross weights, airspeed, altitude, CG, etc. The helicopter is tuned at 103% N_r to attain optimum performance and smooth operation, and N_r should be selected in the range of 100 to 103% which results in smoothest flight. The notes on the performance charts in the Appendix indicate the differences in performance, if any, when operating at other than 103% N_r. For proper management of fuel, refer to FUEL SYSTEM MANAGEMENT, Section VII.

BEFORE LANDING.

Prior to landing, the pilot will brief on approach procedures, intentions, significant terrain features, specific crew requirements, and other pertinent facts. Advise passengers as required and ensure cabin security.

The pilot initiates the Before Landing Checklist by stating "Landing gear — (as required), Before Landing checklist." The copilot responds, "Landing gear — (as required)" and positions the gear handle. The (CP/FE) silently completes items 1 through 6, and verbally calls item 7.

NOTE

A maximum power available check is required prior to the first landing in a remote area and prior to operation at or near the maximum capability of the helicopter.

1. Fuel — CHECKED. (CP/FE)

CAUTION

If one fuel low level caution light comes on, turn on all available boost pumps and open the crossfeed. If both fuel low caution lights come on, turn on all available boost pumps, open the crossfeed and avoid noseup attitudes greater than 6 degrees.

2. Engine and transmission instruments — CHECKED. (CP/FE)

3. Parking brake — AS REQUIRED. (CP/FE)

NOTE

Parking brake should be locked when landing with nosewheel lock engaged.

4. Throttles — 103% N_r. (CP/FE)

   Use maximum N_r on final approach as required.

5. AN/ALE-20 arming switch — AS REQUIRED. (CP/FE)

6. Landing gear — AS REQUIRED. (CP/FE)

   Check landing gear position indicators.

7. "Before Landing checklist completed." (CP/FE)

TRAFFIC PATTERN.

The pilot initiates this checklist after takeoff by stating "Landing Gear — (as required), Traffic Pattern Checklist." The CP/FE responds, "Landing gear (as required)," verbally confirms the gear handle is positioned properly and silently completes item 1 through 4, calling out item 5.

NOTE

The landing gear will remain down during all multiple land traffic patterns and will remain up during all multiple water traffic patterns.

1. Engine and transmission instruments — CHECKED. (CP/FE)

2. Landing gear — INDICATORS CHECKED. (CP/FE)

3. Lights — AS REQUIRED. (CP/FE)

4. Throttles — 103% N_r. (CP/FE)

5. "Traffic Pattern checklist completed." (CP/FE)

GROSS WEIGHT AND CENTER OF GRAVITY LIMIT.

The landing gross weight and center of gravity of the helicopter are important factors to be considered when determining the feasibility of a helicopter landing. In all instances, the fuel load, equipment, cargo, and personnel should be situated so as not to disturb the desired center of gravity of the helicopter. Refer to WEIGHT LIMITATIONS, Section V, to ensure that the maximum gross weight for landing is not exceeded.

LANDING.

APPROACH AND LANDING.

During the final approach phase, recheck the landing gear and beep throttles to maximum N_r, if operational requirements dictate. Fly a pattern that will provide an approach and landing appropriate for the landing site (see figure 2-9). On final approach reduce airspeed and establish desired approach angle to the landing site. Airspeed and altitude should be dissipated simultaneously to attain a hover over the intended landing site, then slowly reduce collective for a vertical descent and landing. The approach may also be made to a touchdown without coming to a hover.

WARNING

High rates of descent combined with low forward airspeed should be avoided. For hazards associated with power settling refer to Section VI.

CAUTION

- Do not exceed 12 degree, noseup attitude at the point of ground contact. At 15 degree, noseup attitude, the tail pylon will contact the ground on landing.
- Those helicopters equipped with a refueling probe normally will not accomplish takeoffs and landings with the probe extended.

TOUCH AND GO LANDINGS.

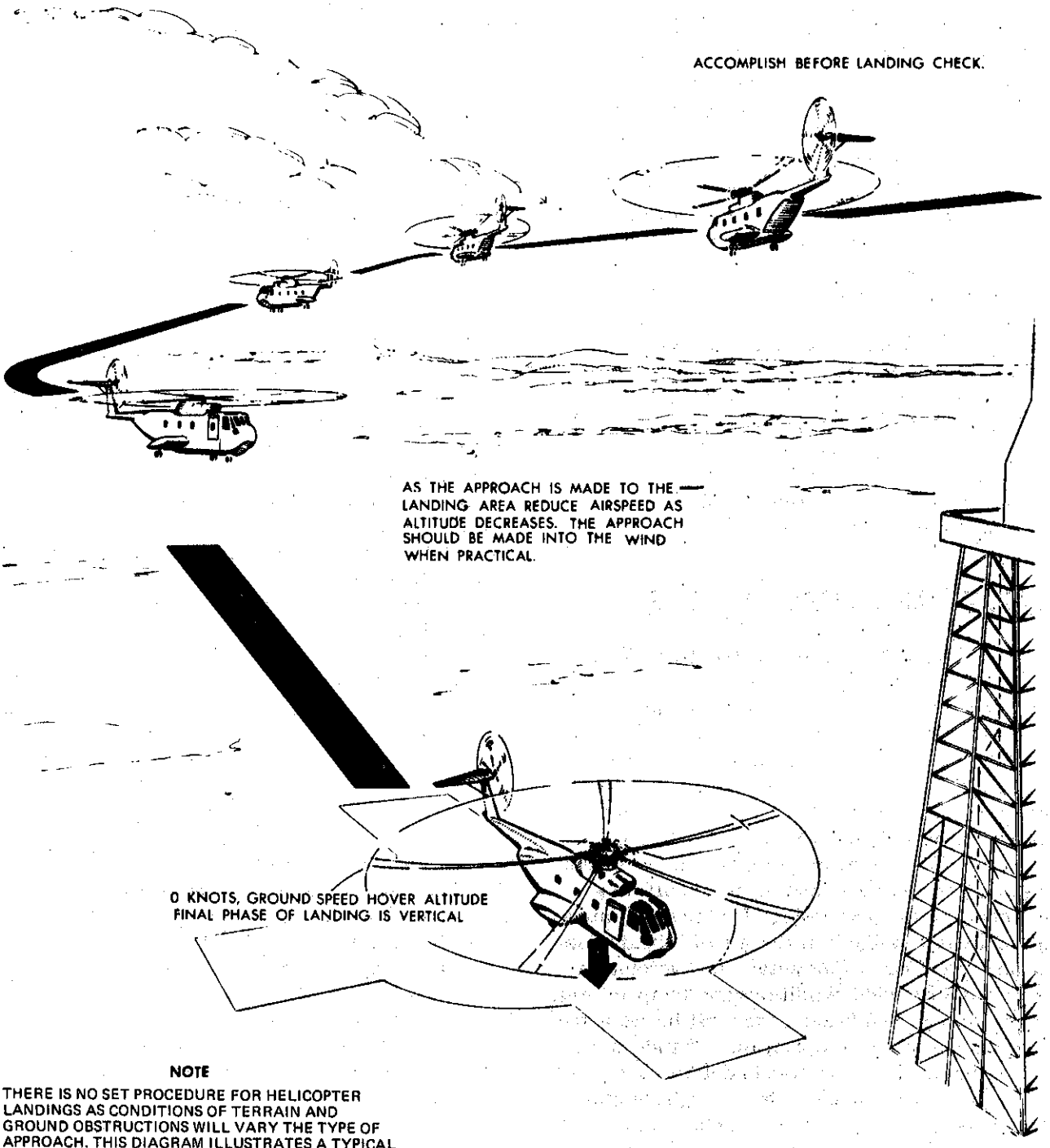
For touch and go landings follow the procedures for a normal running landing. Check collective lever in the minimum position, throttles forward, then follow the procedures for a normal running takeoff.

RUNNING LANDING.

Before attempting a running landing, the surfaces should be checked from low altitude to determine the feasibility of accomplishing the landing. Running landings are usually accomplished from a shallow approach when the helicopter cannot be hovered due to a high gross weight or altitude. Running landings should be accomplished with the nosewheel unlocked and parking brakes off. Adjust collective pitch, as necessary, to maintain the desired approach angle and dissipate speed gradually throughout the approach so the landing can be accomplished while maintaining translational lift. Establish a straight track over the ground and a shallow approach with a slow rate of descent. Use tail rotor pedals to maintain heading in direction of track and cyclic stick to control drift. As the helicopter approaches the ground, increase collective pitch slightly to reduce rate of descent and airspeed to minimum value compatible with gross weight and altitude conditions, and maintain a steady attitude. Aircraft should not exceed 40 knots ground speed during touchdown. As the wheels contact the ground, hold the cyclic stick steady and slowly decrease collective pitch to minimum. The helicopter should be stopped with the wheel brakes.

CAUTION

- To avoid skidding and blowing tires, reduce collective pitch to minimum before applying brakes.
- A running landing should not be attempted with the nose landing gear cocked.



NOTE

THERE IS NO SET PROCEDURE FOR HELICOPTER LANDINGS AS CONDITIONS OF TERRAIN AND GROUND OBSTRUCTIONS WILL VARY THE TYPE OF APPROACH. THIS DIAGRAM ILLUSTRATES A TYPICAL APPROACH PATTERN FOR LANDING IN AN UNOBSTRUCTED AND A DESIGNATED LANDING AREA. THE APPROACH MAY ALSO BE MADE SHALLOW OR NEARLY VERTICAL AS REQUIRED BY LOCAL CONDITIONS.

Figure 2-9. Normal Landing (Typical)

CROSSWIND LANDING.

CAUTION

Crosswind landings are prohibited in winds exceeding 35 knots. Crosswind landing procedures are the same as into the wind vertical landing procedures, except the cyclic stick must be displaced into the wind to prevent sideward drift. The cyclic displacement should not be released on the touchdown as this will reduce the force holding the helicopter in a vertical position. Under extreme conditions, crosswinds could result in the helicopter being overturned. During crosswind landings, with the wind from the right, it may be noted that tail rotor control may run out. This happens at high gross weights when leaving an approach and entering a hover. This is a result of weather vaning and rotor torque which causes the helicopter to turn to the right.

REMOTE AREA OPERATIONS.

MOUNTAIN AND ROUGH TERRAIN FLYING.

Many helicopter missions require flight and landings in rough and mountainous terrain. Refined flying techniques along with complete and precise knowledge of the individual problems to be encountered are required: Landing site condition, wind direction and velocity, gross weight limitations, and effects of obstacles are but a few of the considerations for each landing or takeoff. In a great many cases, meteorology facilities and information are not available at the site of intended operation. The effects of mountains and vegetation can greatly vary wind conditions and temperatures. For this reason each landing site must be evaluated at the time of intended operation. Altitude and temperature are major factors in determining helicopter power performance. Gross weight limitations under specific conditions can be computed from the performance data in the Appendix. A major factor improving helicopter lifting performance is wind. Weight carrying capability increases rapidly with increases in wind velocity relative to rotor system. However, accurate wind information is more difficult to obtain and more variable than other planning data. It is therefore not advisable to include wind in advanced planning data except to note that any wind encountered in the operating area may serve to improve helicopter performance. In a few cases operational necessity will require landing on a prepared surface at an altitude above the hovering capability of the helicopter. In these cases a roll-on landing and takeoff will be necessary to accomplish the mission. Data for these conditions can be computed from the charts in the Appendix.

WIND DIRECTION AND VELOCITY.

There are several methods of determining the wind direction and velocity in rough area. The most reliable method is by the use of smoke generators. However, it must be noted that the hand held day/night distress signal and the standard ordnance issue smoke hand grenade are satisfactory for wind indication but constitute a fire hazard when used in areas covered with combustible vegetation. Observation of foliage will indicate to some degree the direction of the wind, but is of limited value in estimating wind velocity. Helicopter drift determined by eyesight without the use of navigational aids is the first method generally used by experienced pilots. The accuracy with which direction may be determined through the drift method becomes a function of wind velocity. The greater the wind value the more closely the direction may be defined.

CAUTION

Depending on wind velocity, the apparent airspeed/ground speed relationship changes when turning downwind. After the turn less airspeed is required to maintain ground speed. Reducing airspeed may result in loss of translational lift which increases the power required to maintain altitude. When operating close to the surface, especially during downwind maneuvering, airspeed and power required must be monitored closely.

LANDING SITE EVALUATION.

Five major considerations in evaluating the landing area are: (1) height of obstacles which determine approach angle, (2) size and topography of the

landing zone, (3) possible loss of wind effect, (4) power available, and (5) departure route. The transition period is the most difficult part of any approach. As helicopter performance decreases, the transition period becomes more critical, and of necessity approaches must be shallower and transition more gradual. Therefore, as the height of the obstacle increases, larger areas will be required. As wind velocity increases so does helicopter performance; however, when the helicopter drops below an obstacle a loss of wind generally occurs as a result of the airflow being unable to immediately negotiate the change prevalent at the upwind side of the landing zone where a virtual null area exists. This null area extends toward the downwind side of the clearing and will become larger as the height of the obstacle and wind velocity increases. Approaches should be planned to avoid the null area whenever possible and still land in the forward 1/3 of the landing site. The null area is of particular concern in making a takeoff from a confined area. Under heavy load, or limited power conditions it is desired to achieve a significant value of forward velocity and translational lift prior to transitioning to a climb, so that the overall climb performance of the helicopter will be improved. If the takeoff cycle is not commenced from the most downwind portion of the area, and translational velocity achieved prior to arrival in the null area, a significant loss in lift may occur at the most critical portion of the takeoff. It must also be noted that in the vicinity of the null area nearly vertical downdrafts of air may be encountered, which will further reduce the actual climb rate of the helicopter. It is feasible that under certain combinations of limited area, high obstacles upwind, and limited power available, the best takeoff route would be either crosswind or downwind, terrain permitting. The effects of detrimental wind flow and the requirement to climb may thus be minimized or circumvented. Even though this is a departure from the cardinal rule of "takeoff into the wind", it may well be the proper solution when all factors are weighed in their true perspective. Never plan an approach to a confined area wherein there is no reasonable route of departure. The terrain within a site is considered from an evaluation of vegetation, surface characteristics, and slope. Care must be taken to avoid placing the rotors in low brush or branches. Obstacles covered by grass may be located by flattening the grass with rotor wash prior to landing. Power should be maintained so that an immediate takeoff may be accomplished should the helicopter start tipping from soft earth or a gear being placed in a hidden hole.

CAUTION

- Extreme care must be taken to prevent the rotor blades from striking terrain or obstacles on either side of the helicopter.
- 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 system.

NOTE

The pilot should always maintain takeoff rotor speed on an unprepared surface until it has been determined that the surface will support the helicopter. This will permit immediate takeoff if the helicopter should start to tip over or sink into the surface.

Landing on Slippery Areas.

Landing on wet or icy areas is hazardous, and due caution must be exercised when landing or taxiing. Brake action will tend to induce skidding.

EFFECTS OF HIGH ALTITUDES.

Engine power available at altitude is less, and operations can easily be in a situation of limited hovering ability. High gross weight at altitude increases the susceptibility of the helicopter to blade stall. Conditions that contribute to blade stall are high forward speed, high gross weight, high altitude, low rpm, induced G loading and turbulence. Shallower turns at slower airspeeds are required to avoid blade stall. A permissible maneuver at sea level must be tempered at a higher altitude. Smooth and timely control application and anticipation of power requirements will do more than anything else to improve altitude performance.

TURBULENT AIR FLIGHT TECHNIQUES.

Helicopter pilots must be constantly alert to evaluate and avoid areas of severe turbulence; however,

if encountered, immediate steps must be taken to avoid continued flight through it, to preclude the structural limits of the helicopter being exceeded. Severe turbulence is often found in thunderstorms and helicopter operations should not be conducted in their vicinity. The most frequently encountered type of turbulence is orographic turbulence. It can be dangerous if severe and is normally associated with updrafts and downdrafts. It is created by moving air being lifted by natural or manmade obstructions. It is most prevalent in mountainous regions and is always present in mountains if there is a surface wind. Orographic turbulence is directly proportional to the wind velocity. It is found on the upwind of slopes and ridges near the tops, and extending down the downwind slope (figure 2-12). It will always be found on the tops of ridges associated with updrafts on the upwind side and downdrafts on the downwind side. Its extent on the downwind slope depends on the strength of the wind and the steepness of the slope. If the wind is fairly strong (15 to 20 knots) and the slope is steep, the wind will have a tendency to blow off the slope and not follow it down; however, there will still be some tendency to follow the slope. In this situation there will probably be severe turbulence several hundred yards downwind of the ridge at a level just below the top. Under certain atmospheric conditions, a cloud may be observed at this point. On more gentle slopes the turbulence will follow down the slope, but will be more severe near the top. Orographic turbulence will be affected by other factors. The intensity will not be as great when climbing a smooth surface as when climbing a rough surface. It will not follow sharp contours as readily as gentle contours. Manmade obstructions and vegetation will also cause turbulence. Extreme care should be taken when hovering near buildings, hangars, and similar obstructions. The best method to overfly ridgelines from any direction is to acquire sufficient altitude prior to crossing to avoid leeside downdrafts. If landing on ridgelines, (figure 2-10), the approach should be made along the ridge in the updraft, or select an approach angle into the wind that is above the leeside turbulence. When the wind blows across a narrow canyon or gorge, (figure 2-14), it will often veer down into the canyon. Turbulence will be found near the middle and downwind side of the canyon or gorge. When a helicopter is being operated at or near its service ceiling and a downdraft of more than 100 feet per minute is encountered, the helicopter will descend. Although the downdraft does not continue to the ground, a rate-of-descent may be established of such magnitude that the helicopter will continue descending and crash, even though the helicopter is no longer affected by the downdraft. Therefore, the procedure for transiting a mountain pass shall be to fly close aboard that side of the pass or canyon wbich affords an upslope wind. This procedure not only provides additional lift, but also provides a readily available

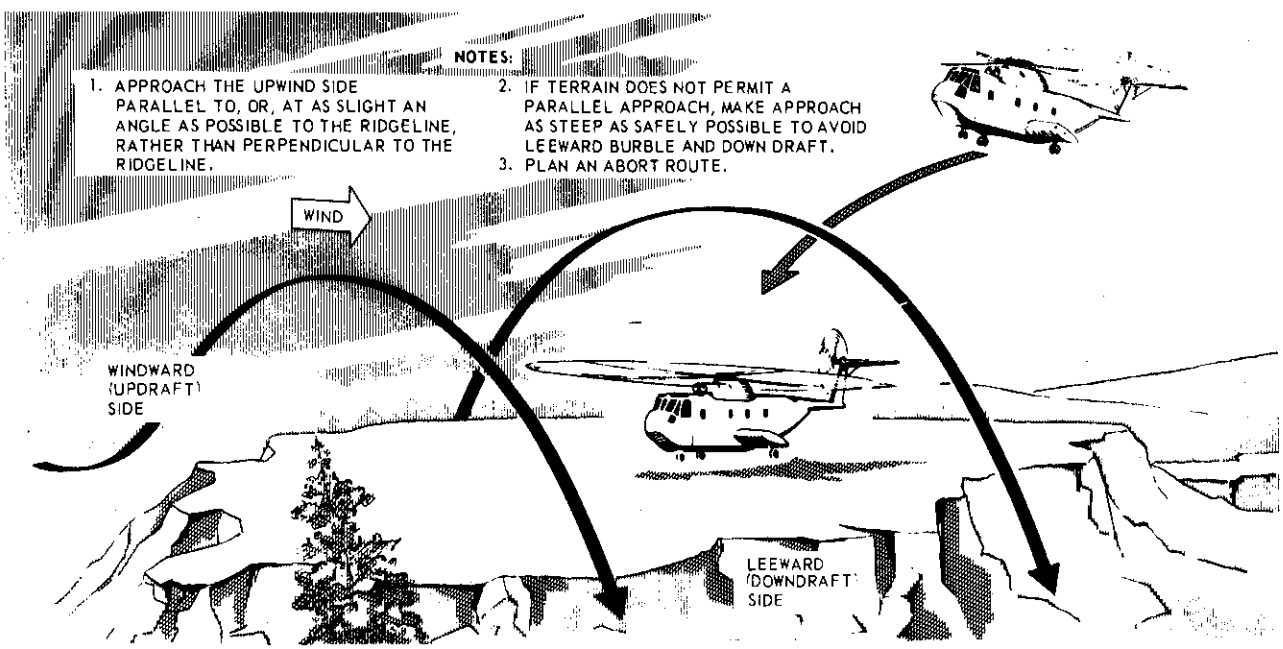


Figure 2-10. Wind Effect on Ridgeline Approach

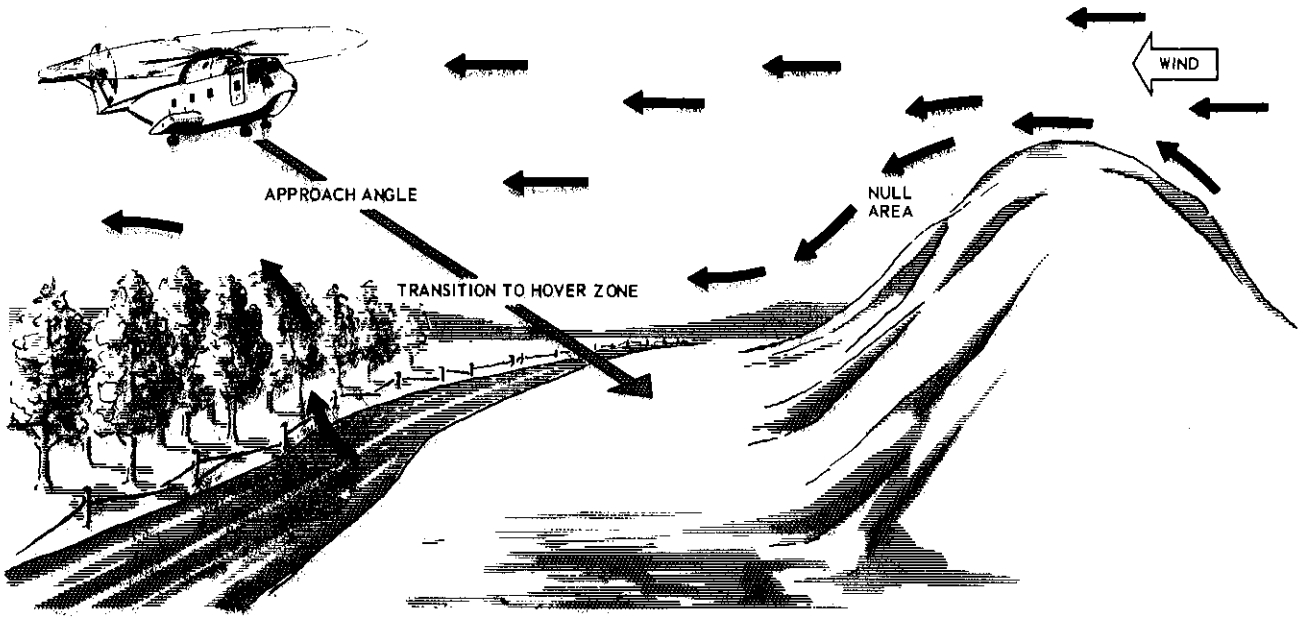
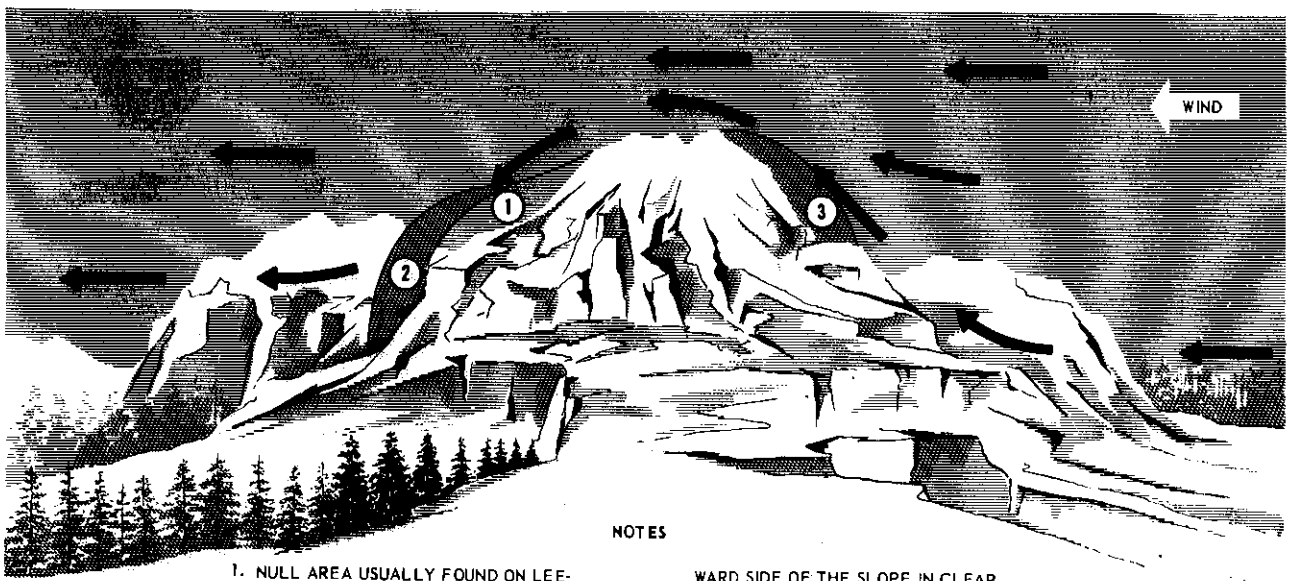


Figure 2-11. Wind Effect in a Confined Area



NOTES

1. NULL AREA USUALLY FOUND ON LEEWARD SIDE AT CREST OF SLOPE.
2. IN VERY STRONG WIND CONDITIONS, AND/OR ON VERY STEEP SLOPES, TURBULENCE WILL BE FOUND ON THE LEEWARD SIDE OF THE SLOPE IN CLEAR AIR.
3. UP-DRAFTS WILL EXTEND ABOVE THE SURFACE FURTHER THAN THE TURBULENCE, DEPENDING ON WIND SPEED.

Figure 1-12. Wind Flow Over and Around Peaks

means of exit in case of emergency. Maximum turning space is available and a turn into the wind is also a turn to lower terrain. The often used procedure of flying through the middle of a pass to avoid mountains invites disaster. This is frequently the area of greatest turbulence (figure 2-13) and in case of emergency, the pilot has little or no opportunity to turn back due to insufficient turning space. Rising air currents created by surface heating causes convective turbulence. This is most prevalent over bare areas. Convective turbulence is normally found at a relatively low height above the terrain, generally below 2000 feet. It may, however, under certain conditions, and in certain areas, reach as high as 8000 feet above the terrain. Attempting to fly over convective turbulence should be carefully considered, depending on the mission assigned. The best method is to fly at the lowest altitude consistent with safety. Attempt to keep your flight path over areas covered with vegetation. Turbulence can be anticipated when transitioning from bare areas to areas covered by vegetation or snow. Convective turbulence seldom gets severe enough to cause structural damage.

Figure 2-13. Wind Flow in Valley or Canyon

Figure 2-14. Wind Flow over Gorge or Canyon