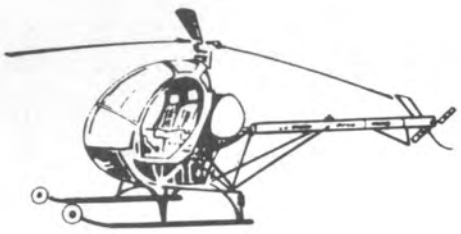
SLOPE AND CONFINED AREA OPERATIONS

PROGRAMED TEXT AM 69

DECEMBER 1970

UNITED STATES ARMY PRIMARY HELICOPTER SCHOOL, FORT WOLTERS, TEXAS



(Tues) 20 July 1971

PROGRAMED TEXT

FILE NO. AM-69 SLOPE & CONFINED AREA OPERATIONS

POI SCOPE:

Explanation of a helicopter confined area and slop operation.

INSTRUCTOR REFERENCES:

PRIMARY FLIGHT TRAINING MANUAL

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DATE:

November 1970

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DATE:

November 1970

TABLE OF CONTENTS

PREFACE

The unique ability of the helicopter to land in unprepared areas has made it the most versatile type of aircraft in military aviation. You will find many occasions throughout your military career when the successful completion of an important mission will depend solely on your ability to land a helicopter in a confined area or on sloped terrain. Therefore, the skills needed to perform these maneuvers must be developed to the highest degree.

PERFORMANCE OBJECTIVES

On completion of this two part programed text and without the aid of references, you will be able to correctly select the purpose, procedures, techniques, and requirements used in executing

PART I confined area operations to include
- a. high recon.
- b. low recon.
- c. ground recon.
- d. takeoff.

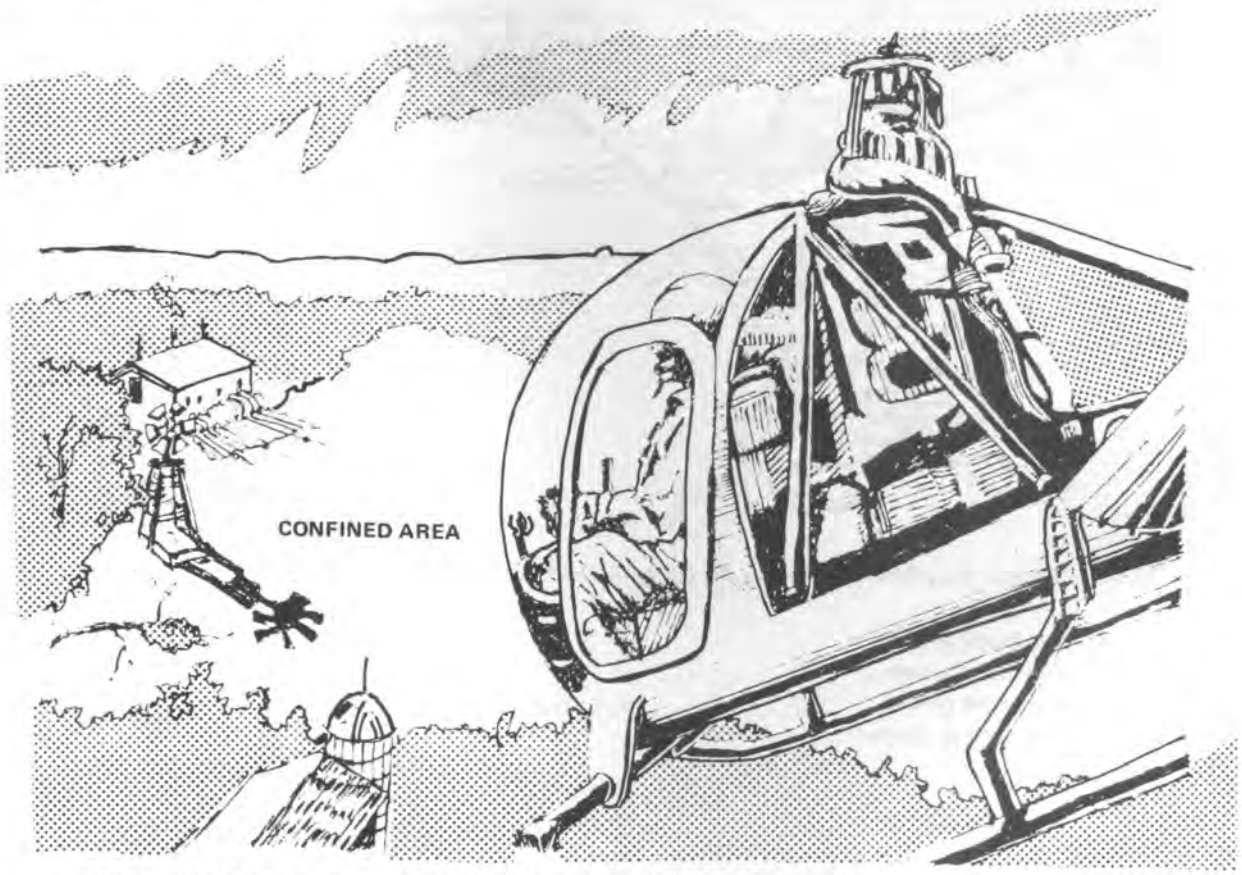
PART II slope operations to include
- a. positioning the aircraft for landing.
- b. initiating the landing.
- c. ground contact.
- d. takeoff.

FRAME 1

A confined area is any location where the operation of the helicopter is restricted by terrain features or man made obstructions.

The first step in planning a landing in a confined area is to make a high reconnaissance of the area. The best forced landing areas should be accessable at all times while making the high recon. During the high recon you will determine the suitability of the area of intended landing by evaluating the

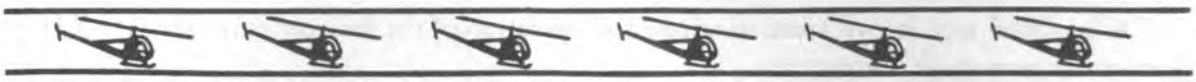
1. wind direction and estimated velocity.
2. location, type, and height of obstruction.
3. best flight path into and out of the area, considering the best forced landing areas and the long axis of the confined area.
4. plan for the approach.



Which of the following is <u>not</u> determined during the high reconnaissance?

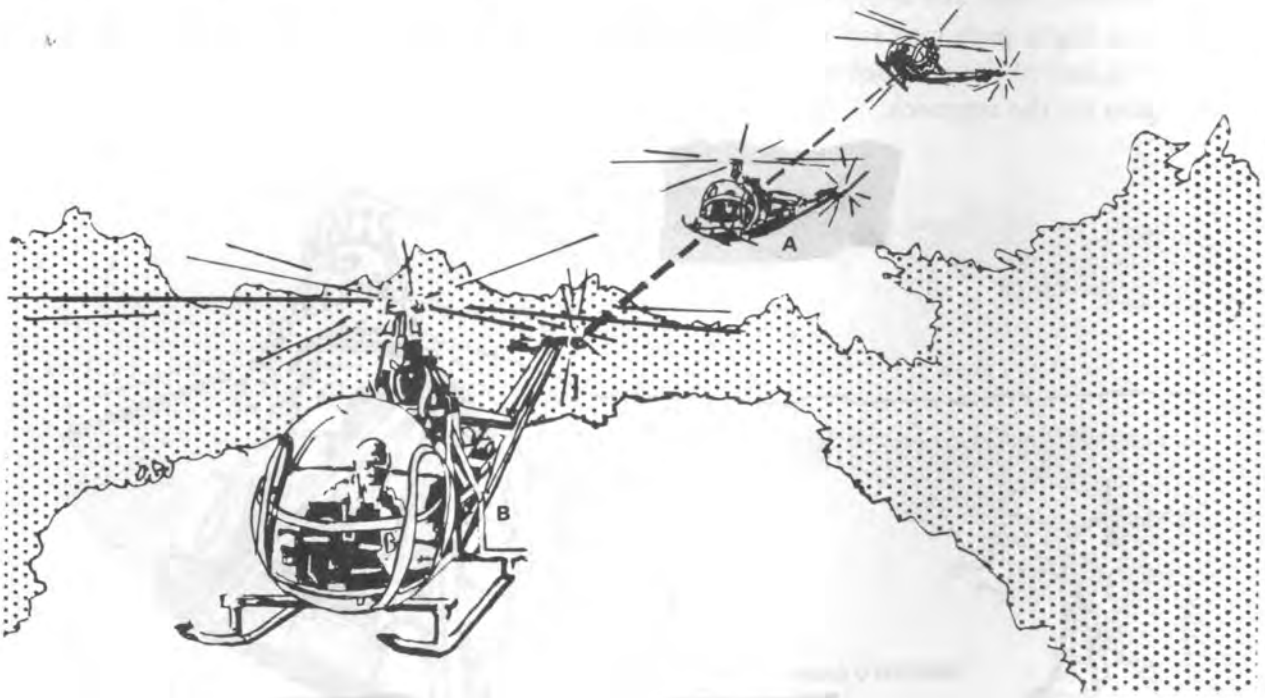
a. Suitability of the intended landing area.
b. Takeoff point.
c. Evaluation of obstacles.
d. Route of flight into and out of the area.

ANSWER: b. between 10-20 degrees and sufficient to clear all barriers by 10 feet.



FRAME 8

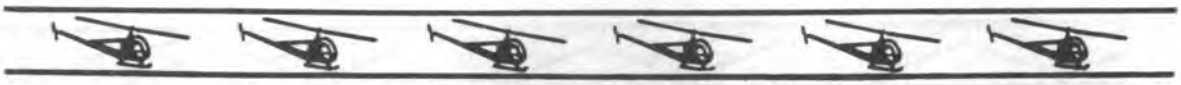
If a go-around is made on the low recon, it should be made prior to loss of translational lift and before descending below the level of the surrounding barriers. Initiate the go-around by applying hover power and assuming a normal climb attitude.



At what point in the above picture can the pilot still make a go-around?

a. A, using hover power.
b. A, using cruise power.
c. B, using hover power.
d. B, using cruise power.

ANSWER: b. Takeoff point.



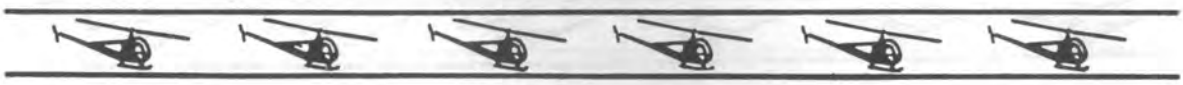
FRAME 2

The high recon is flown at 50 knots, 500 feet AGL, and hover RPM. Adjust your flight path to view the area from an angle of 30 to 45 degrees. This angle will allow you to make the best estimate of the presence, height and size of obstacles, and the size of the area of intended landing.

The high reconnaissance of a confined area is flown at

a. 500',50 knots and a 20-45 degree angle.
b. 500',50 knots and a 30-50 degree angle.
c. 500',50 knots and a 30-45 degree angle.

ANSWER: a. A. using hover power.



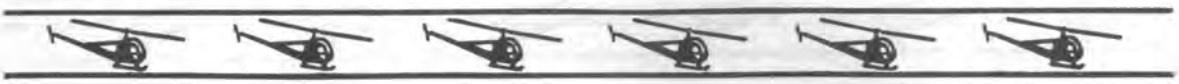
FRAME 9

As the helicopter touches the ground, slowly lower the collective pitch to the full down position while maintaining RPM. With the collective pitch to the full down, check the stability of the helicopter by slowly moving the cyclic and pedals. If the helicopter shows signs of instability, reposition the helicopter to a more stable location. Before getting out of the aircraft, level the rotor disc with the apparent horizon, reduce engine RPM to 1850 for the TH-55 and 2200 for ~~OH-23D~~, and apply friction to all the controls to include the mechanical lock on the collective. Use caution when exiting the helicopter, be careful not to walk upslope under the main rotor or back into the tail rotor.

To determine the stability of the helicopter after landing,

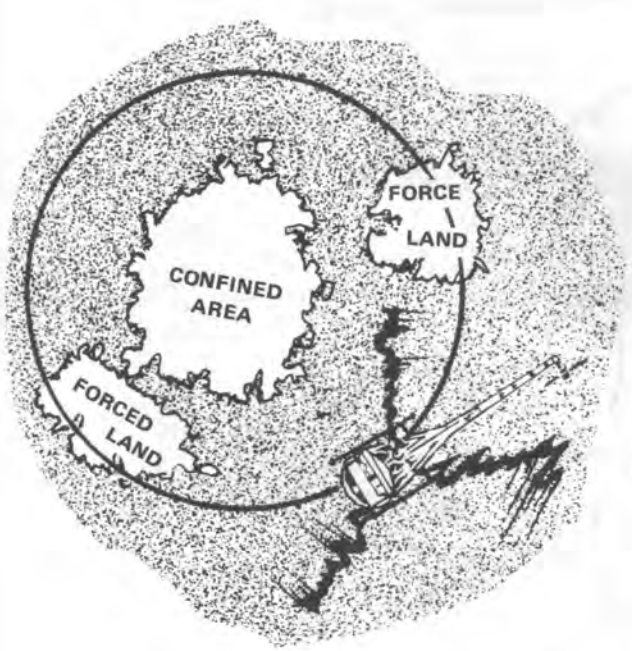
a. maintain a light collective, hover RPM, and move the cyclic and pedals back and forth.
b. reduce RPM to 1850 in TH-55 or 2200 in OH-23D, and move the pedals and cyclic in a circular motion.
c. lower collective full down, hover RPM, and move the cyclic and pedals back and forth.
d. reduce RPM to 1850 in TH-55, or 2200 RPM in OH-23D and move the collective up and down.

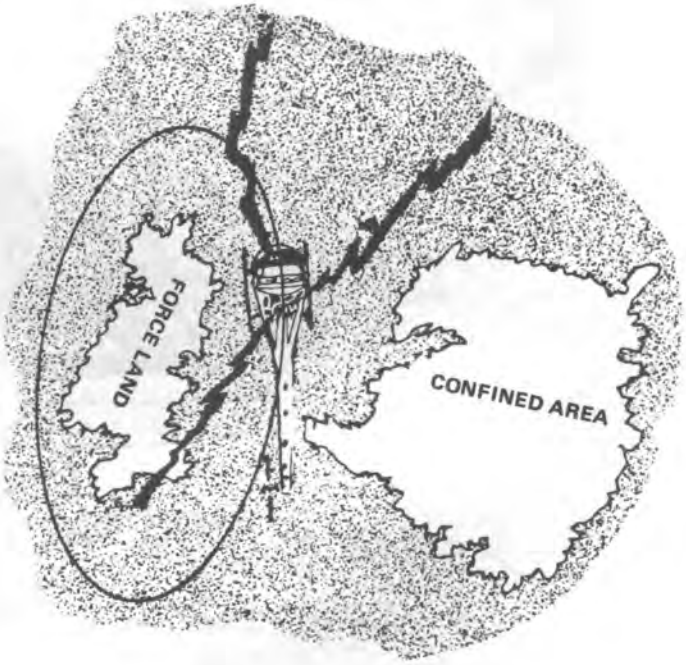
ANSWER: c. 500',50 knots and a 30-45 degree angle.



FRAME 3

When forced landing areas permit, the high reconnaissance should be flown completely around the area of intended landing. Since forced landing areas are not always available within 360 degrees of a confined area, it may be necessary to modify your high recon. This can be accomplished by flying back and forth along one or more sides or any pattern which will take advantage of the forced landing areas available while evaluating the area.





The best way to fly the high recon is

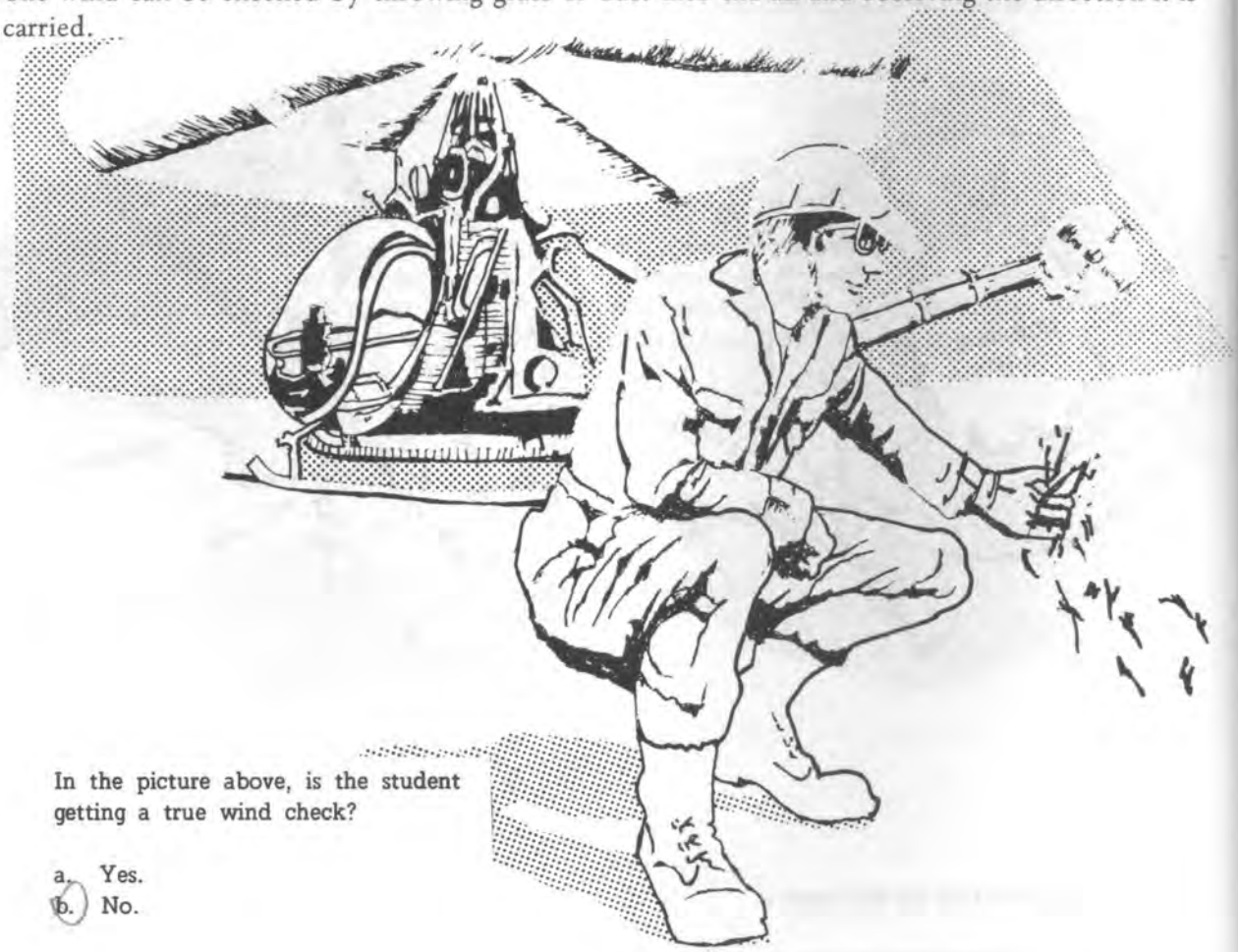
a. back and forth over the area, always keeping it in reach.
b. back and forth along the area taking advantage of the forced landing areas available.
c. completely around the area of intended landing whether or not forced landing areas are available.

ANSWER: c. lower collective full down, hover RPM, and move the cyclic and pedals back and forth.

FRAME 10

The purpose of a ground reconnaissance is to gather information to be used in formulating a plan for the maneuvering of the helicopter in the confined area; taking safe and maximum advantage of the space available for takeoff.

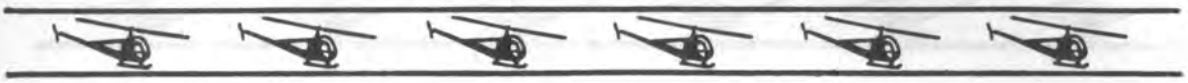
The ground recon consist of four steps, the first being the initial wind check. This is accomplished by moving directly forward of the aircraft to the most upwind position of the area. The wind can be checked by throwing grass or dust into the air and observing the direction it is carried.



In the picture above, is the student getting a true wind check?

a. Yes.
b. No.

ANSWER: b. back and forth along the area taking advantage of the forced landing areas available.



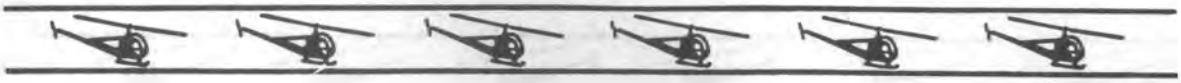
FRAME 4

There are several means of evaluating the wind to determine its direction and estimated velocity. Check the surrounding area for smoke, ripples on ponds, and movement of leaves on the trees. All of these can be used to evaluate the wind. The wind and height of barriers are important factors in determining the approach path into and departure path out of the area. Check the height and location of the barriers and note the long axis of the area. Plan your approach generally along the long axis, into the wind, and over terrain that minimizes the time that you are not within reach of forced landing areas.

After evaluating the conditions pictured above, which approach path would you use to land in the confined area?

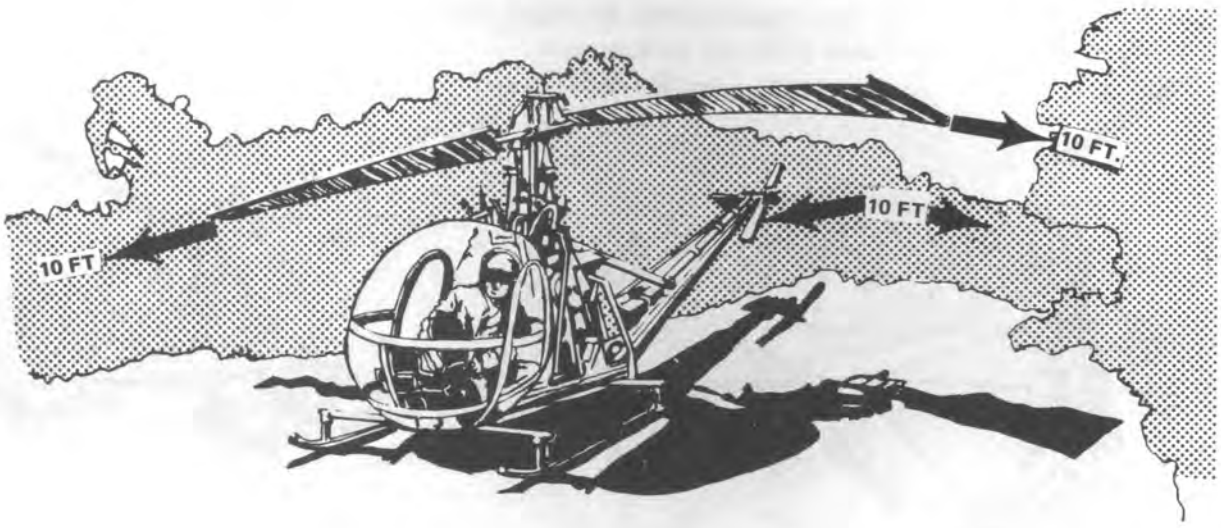
a. A.
b. B.
c. C.
d. D.

ANSWER: b. No. The student is too close to the aircraft to obtain a true reading. The rotor wash will effect the direction the grass will be blown.



FRAME 11

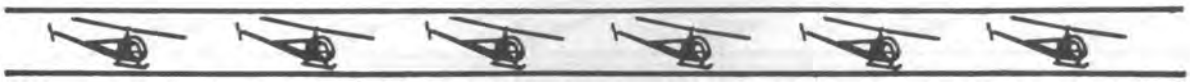
Next, move to the most downwind portion of the area and observe all obstacles and hazards to your hover; select and mark your desired takeoff point. There must be a 10 foot clearance between your main rotor, tail rotor, and all obstacles. Plan to takeoff over the lowest barriers possible, keeping in mind wind direction, velocity, and forced landing areas.



An important factor to be considered in the development of a hover plan is a

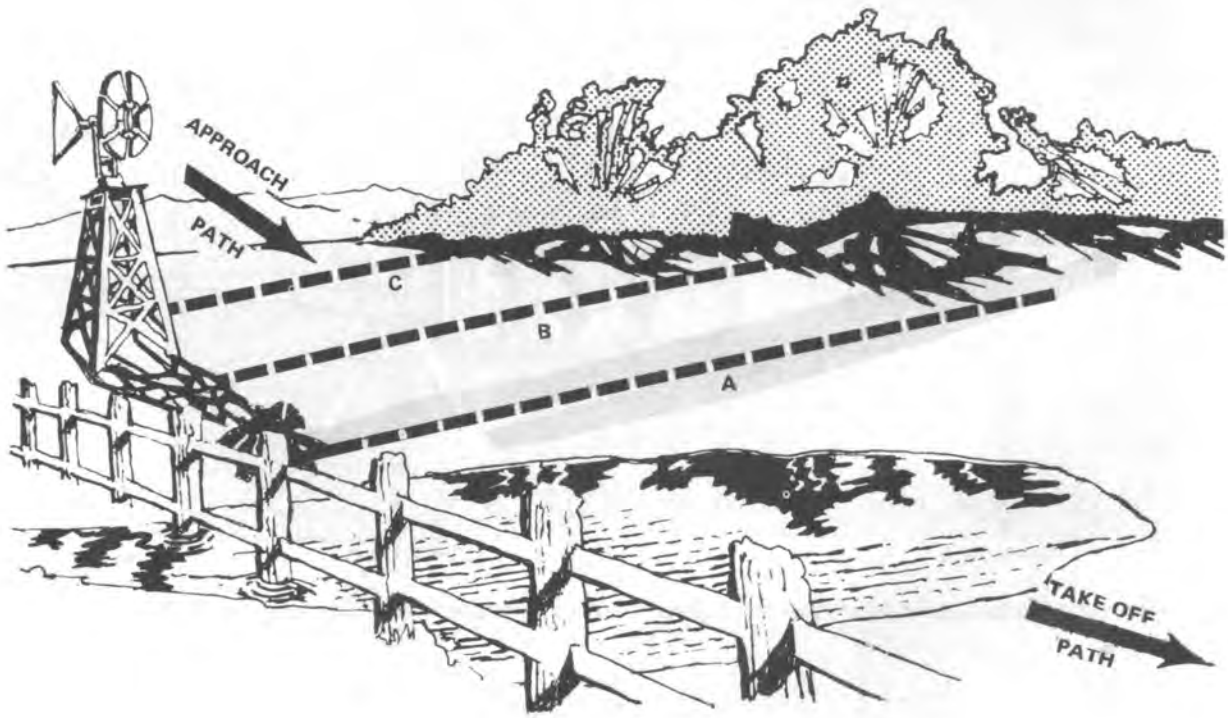
a. 10 foot clearnace between the main rotor and all obstacles.
b. 10 foot clearance between the tail rotor and all obstacles.
c. 10 foot clearance between the main rotor and tail rotor and all obstacles.
d. 10 foot clearance between the center line of the aircraft and all obstacles.

ANSWER: a. B.



FRAME 5

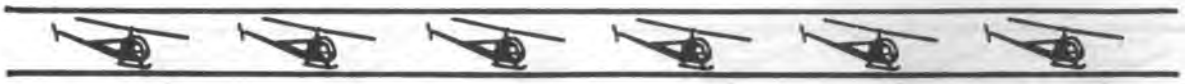
Plan your approach to clear all barriers by 10 feet and to maintain your approach angle to the point of landing, which should be in the upper 1/3 of the area. Another selection to be made on the high recon is the takeoff path out of the confined area. Factors to consider when making this selection include wind direction and velocity, and forced landing areas available. It may be to your advantage to takeoff at an angle to the wind as the forced landing areas may not be available for a takeoff directly into the wind. Finally, pick out check points which can be used to keep you oriented, while you are on the ground. On the ground, you should be able to find the exact takeoff path you selected while in the air.



In the illustration above, you would plan your approach to area

a. A.
b. B.
c. C.

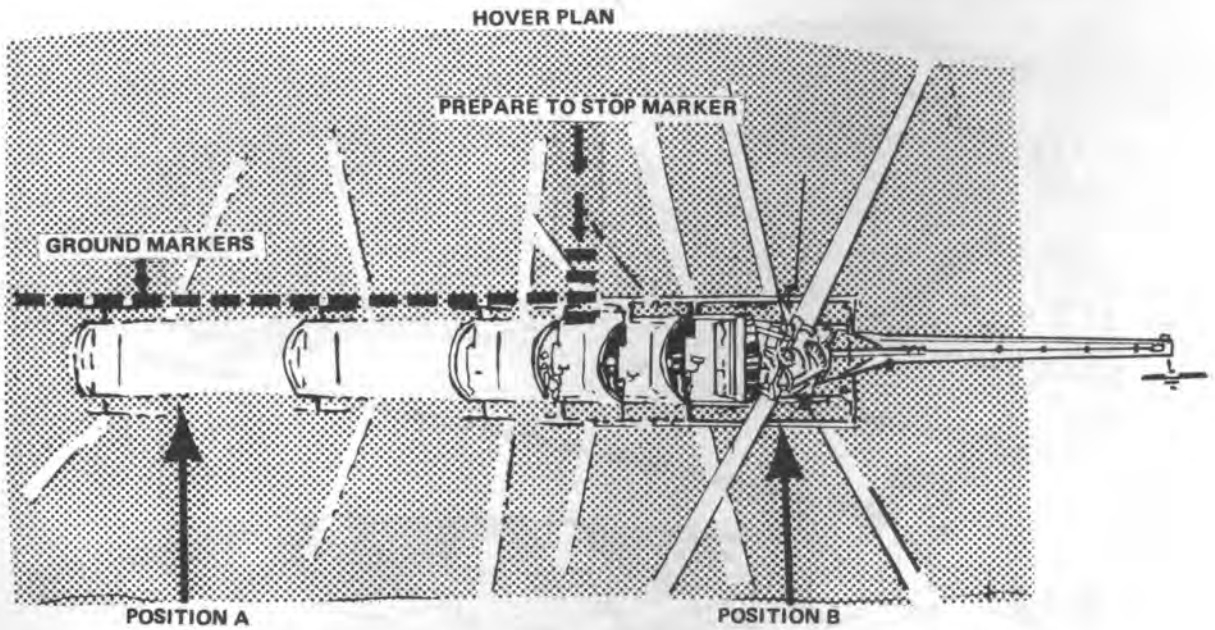
ANSWER: c. 10 ft clearance between the main rotor and tail rotor and all obstacles.



FRAME 12

Now you must execute your hover plan. The most desirable method is to turn the aircraft around and hover straight to your takeoff point. If you must hover rearward, place markers on the ground to indicate your turn around points and rearward hover paths. Place a "prepare to stop" marker four or five paces in front of your takeoff marker. Hovering rearward, align your markers with the right skid rather than directly under the helicopter; this will give you better visibility of your markers.

Before re-entering the helicopter, return upwind and check the wind once more.

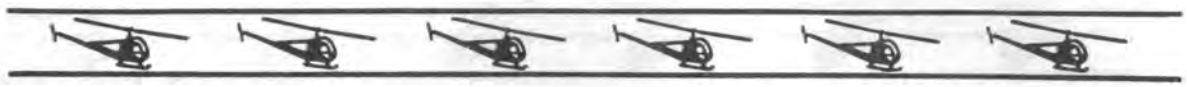


Remember: Do not make your markers so large that they interfere with the hovering of the aircraft.

The most desirable method of repositioning the helicopter from the touch-down point to the takeoff point is to

a. hover rearward.
b. hover sideways observing all obstacles for proper clearance.
c. turn around and hover straight to your takeoff point.
d. ground taxi.

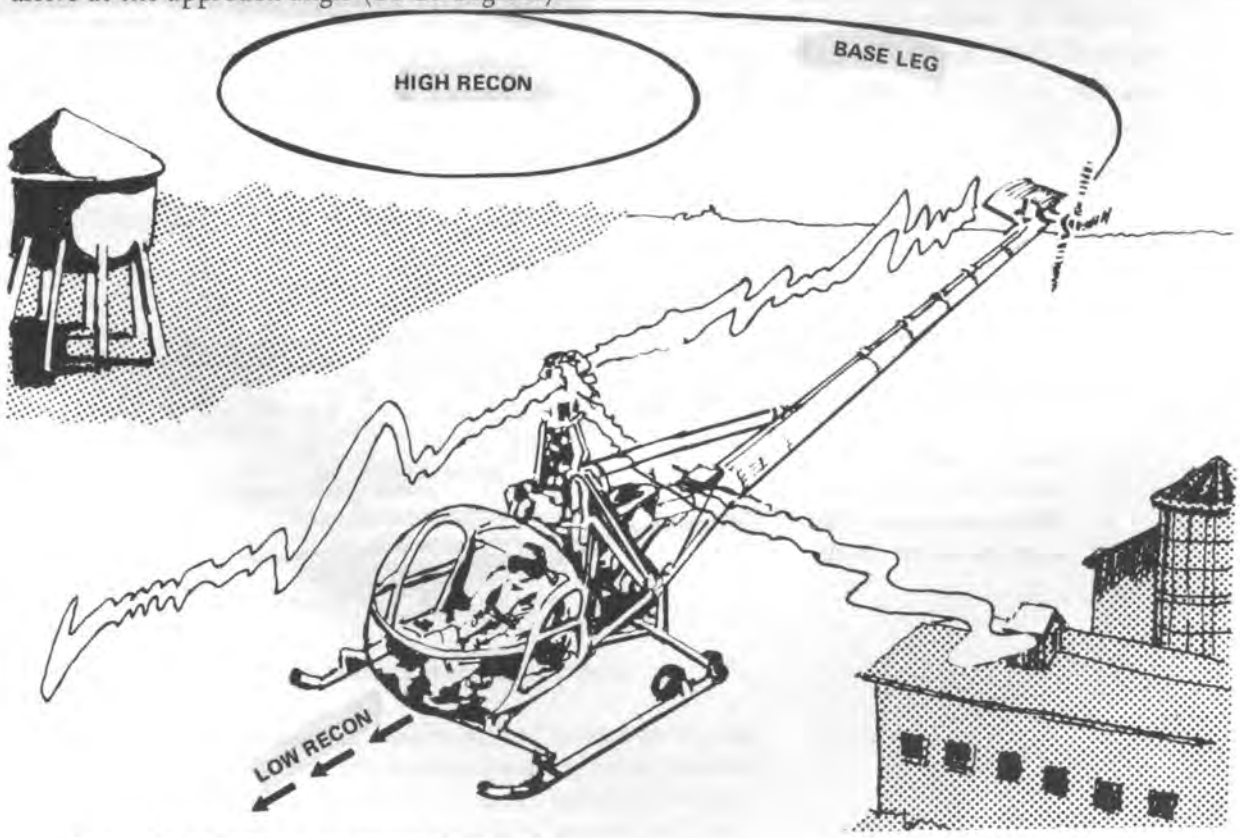
ANSWER: c. A.



FRAME 6

The next step in a confined area operation is the low reconnaissance which is conducted on final approach. The purpose of a low recon is to confirm what you observed on the high recon, to locate any obstacles not visible before, and to position the helicopter on the final approach path for landing.

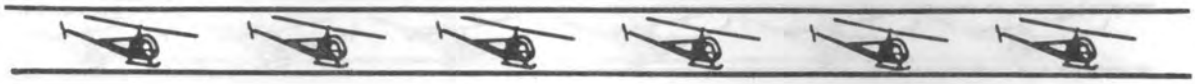
To prepare for a low reconnaissance and landing, maintain 500 feet and 50 knots, select a final approach path, and turn to final approach leg. Hold your altitude and airspeed until you arrive at the approach angle (10-20 degrees).



During the low recon, you should confirm the

a. high recon and select the touch down point.
b. high recon and check for unseen obstacles.
c. approach direction and wind direction.
d. approach direction and alternate landing plan.

ANSWER: c. turn around and hover straight to your takeoff point.



FRAME 13

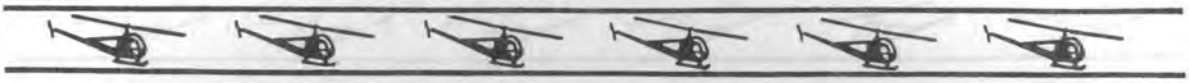
After re-entering the helicopter and fastening your seat belt , release the mechanical collective lock, then remove friction from the throttle. Increase the engine takeoff RPM and perform a magneto check to insure the engine is running properly and the plugs were not fouled while the engine was operating at reduced RPM.

Hover to the takeoff point, utilizing your ground markers correctly. Upon reaching the takeoff point, check the manifold pressure gauge for the power it takes for a stabilized hover. Land the aircraft, reduce RPM to between 2400-2600 in TH-55, and 2200 in OH-23D, and clear yourself to insure that there are no other aircraft in the immediate area. Increase throttle to takeoff RPM in the OH-23D, apply carburetor heat to remove any ice which might have built up on the carburetor while the engine was idling. Return the carburetor heat to the full cold position.

Before hovering for a takeoff, perform a

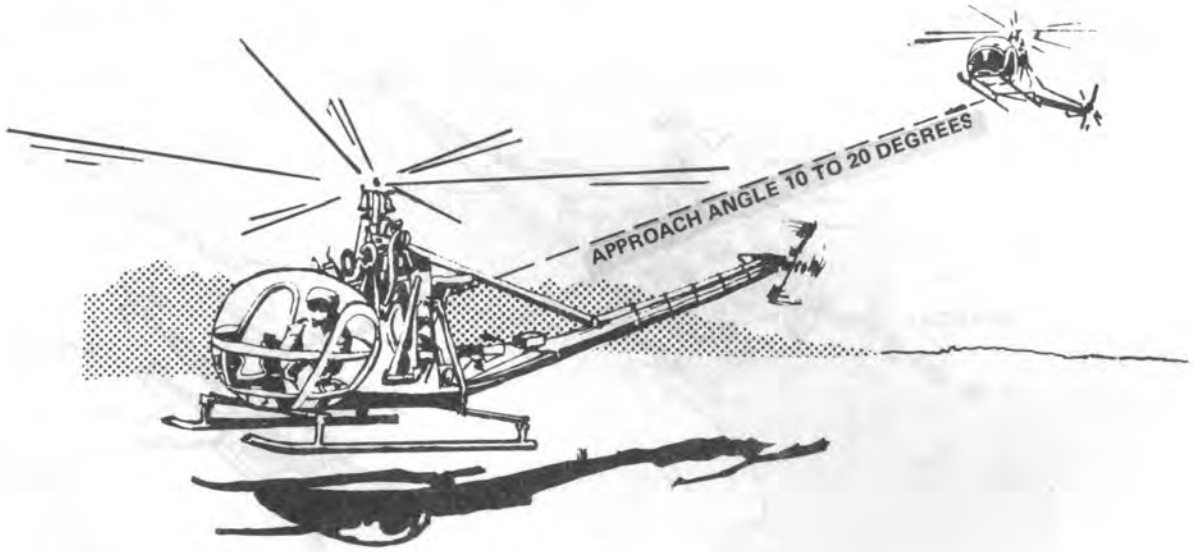
a. magneto check.
b. fuel/air mixture check.
c. 360 degree clearing turn.
d. electrical system check.

ANSWER: b. high recon and check for unseen obstacles.



FRAME 7

Now that you are on the approach and at an angle that will clear all barriers vertical and horizontally by 10 feet, lower the collective pitch and begin the final approach. Maintain your selected approach angle with the proper correlation between rate of closure and descent. Continue your evaluation of the landing zone and approach until termination at a 3 foot hover or landing in the upper 1/3 of the area. It may be necessary to maneuver the helicopter on final to take advantage of the terrain feature along the approach path. At no time should the approach angle exceed 20 degrees. ***A confined area approach*** is an approach to the ground. However, if you notice that the terrain is unsuitable for an approach to the ground during your low recon, terminate your approach at a 3 foot hover. Make a careful evaluation of the terrain before the actual touchdown.



Your approach should be made at an angle between

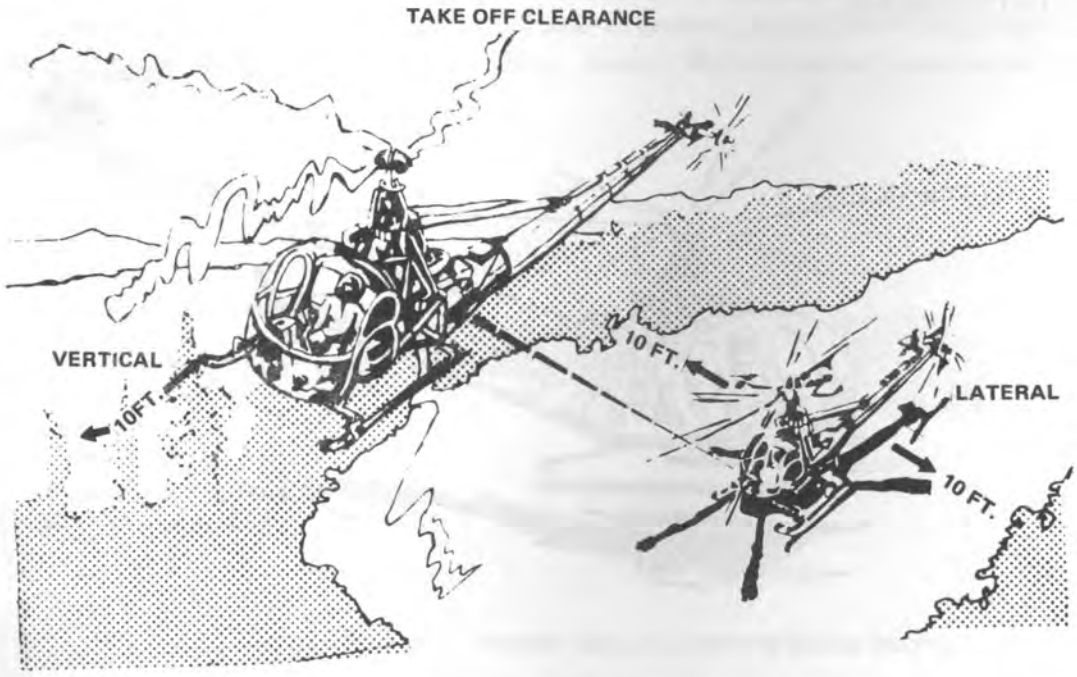
a. 10-20 degrees and sufficient to clear all barriers by five feet.
b. 10-20 degrees and sufficient to clear all barriers by ten feet.
c. 18-20 degrees and sufficient to clear all barriers by ten feet.
d. 15-20 degrees and sufficient to clear all barriers by 15 feet.

RETURN TO PAGE 2 FOR FRAME 8

ANSWER: a. magneto check.

FRAME 14

Takeoff from a confined area is usually made from the ground in a 30 knot attitude and only the minimum power above hover power to clear the obstacles by a minimum of 10 feet. (Do not reduce the power below hover power). The takeoff path should be over the lowest barriers which will allow you to take advantage of the wind and terrain. The barriers should be cleared by a minimum of 10 feet both vertically and horizontally. Upon clearing the barriers, maintain your present power setting and accelerate to normal climb speed. Just prior to reaching normal climb speed, reduce to hover power so as to arrive at normal climb speed and hover power simultaneously. Continue your climb to at least 500 feet AGL.



Remember you should always take into consideration the effect existing winds will have on your takeoff and takeoff path. A 90 degree crosswind is treated as a no wind condition as far as the power required for takeoff, but it will effect the amount of pedal available during takeoff.

What will your takeoff attitude be?

a. 10 knots.
b. 20 knots.
c. 30 knots.
d. 40 knots.

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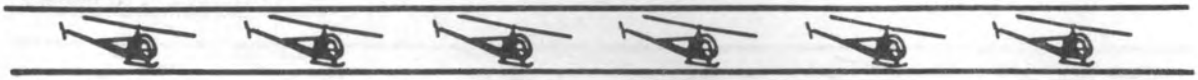
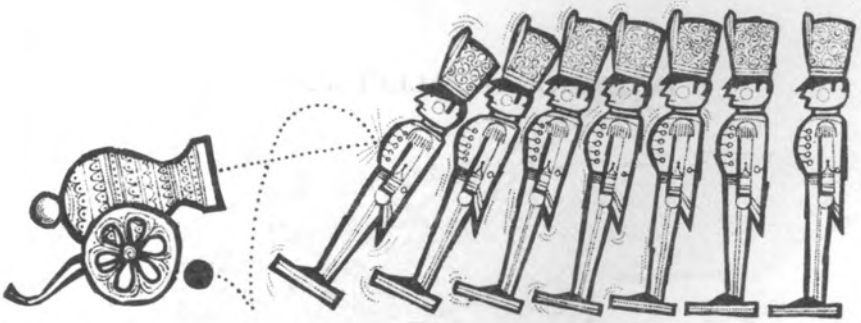
ANSWER: c. 30 knots.





CONTINUE ON TO THE SELF-EVALUATION EXERCISE

SELF EVALUATION EXERCISE

1. Wind direction and velocity are initially determined during the

   a. approach.
   b. high recon.
   c. low recon.
   d. ground recon.

2. During the high reconnaissance, the confined area is observed from

   a. directly above.
   b. either side.
   c. a 20 to 45 degree angle.
   d. a 30 to 45 degree angle.

3. The high recon is flown at

   a. 500 feet and 30 knots.
   b. 500 feet and 40 knots.
   c. 500 feet and 50 knots.
   d. 500 feet and 60 knots.

4. While making the high recon, the pilot should determine and evaluate

   a. the suitability of the area.
   b. barriers.
   c. the entry and exit flight path.
   d. all of the above.

5. Before exiting the aircraft to make a ground recon, you should

   a. set idle RPM and friction controls.
   b. set cruise RPM and friction controls.
   c. center cyclic and collective.
   d. center cyclic and pedals while maintaining cruise RPM.

6. The primary purpose of the low recon is to

   a. determine initial hover plan.
   b. confirm what was seen on the high recon.
   c. check for other helicopters.
   d. check for a good takeoff point.

7. If a go-around is made, it should be made prior to

   a. loss of translational lift.
   b. loss of translational lift and before descending below the level of the barriers.
   c. reaching an altitude of 50 feet and an airspeed of 30 knots.
   d. reaching a 3 foot hover.

8. During the ground recon, the initial wind check is made

   a. before hovering backwards.
   b. before setting up a hover plan.
   c. prior to takeoff.
   d. after a magneto check.

9. Confined area takeoffs should be made

   a. with minimum power above hover power.
   b. from the upper 1/3 of the area.
   c. prior to making a magneto check.
   d. utilizing a 20 knot attitude.

10. The Hover plan must allow for a rotor tip clearance of any obstacle by

   a. 10 feet.
   b. 15 feet.
   c. 20 feet.
   d. 25 feet.

11. The high recon should always be flown

   a. only in a circular pattern to take advantage of forced landing areas.
   b. back and forth on one or more sides taking advantage of forced landing areas.
   c. in any desired pattern which will take advantage of the forced landing areas.
   d. in a rectangular pattern taking advantage of forced landing areas.

12. "Prepare to stop" markers are used

   a. during the high recon to determine the suitability of an area.
   b. during the low recon to determine the landing point.
   c. when hovering to your takeoff point in the confined area.
   d. to mark the point where a go-around must be started if one is needed.

13. Before takeoff from a confined area, you should

a. make a 90 degree clearing turn.
b. check oil quantity.
c. check the magnetos.
d. make a mixture check.

14. The low recon is terminated

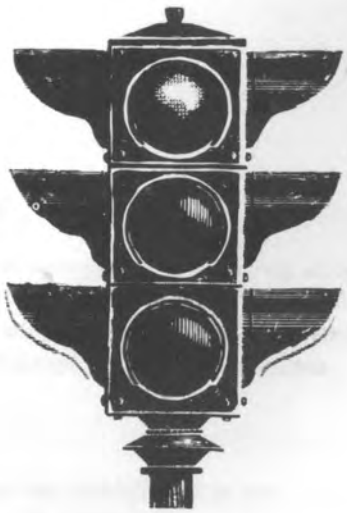
a. when you have cleared all the barriers.
b. when you begin the approach.
c. ten feet above the highest barriers.
d. when you have completed the approach.

15. In a confined area, the touchdown point will be in the

a. upper two-thirds of the area.
b. lower one-third of the area.
c. upper one-third of the area.
d. middle one-third of the area.

ANSWERS TO SELF EVALUATION EXERCISE

1. b. . . . . Page 1
2. d. . . . . Page 3
3. c. . . . . Page 3
4. d. . . . . Pages 1, 3, & 7
5. a. . . . . Page 6
6. b. . . . . Page 11
7. b. . . . . Page 2
8. b. . . . . Page 4
9. a. . . . . Page 14
10. a. . . . . Pages 8 & 10
11. c. . . . . Page 5
12. c. . . . . Page 10
13. c. . . . . Page 12
14. d. . . . . Page 13
15. c. . . . . Page 9



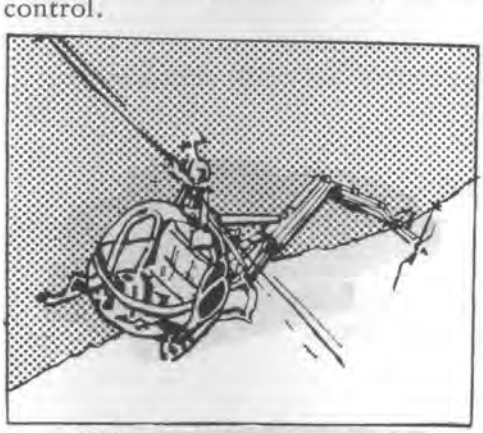
DON'T STOP NOW----CONTINUE TO PART II

PART II SLOPE OPERATIONS

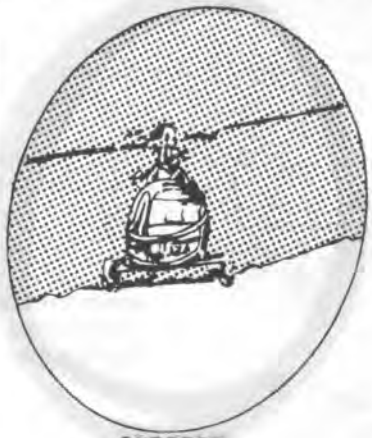
FRAME 1

The purpose of a slope operation is to safely land the helicopter on uneven or rough terrain. A helicopter is ideally suited for operations into and out of unprepared areas. In order to exploit this capability, all aviators must develop the highest degree of skill at landing in rough, uneven, and sloped areas. During your training, you will initially learn slope operations under the supervision of your instructor pilot at specially designated slope areas. In later training at this school, however, you will initially learn slope operations under the supervision of your instructor pilot at specially designated slope areas. In later training at this school, however you will frequently operate in confined and pinnacle areas, all of which will be rough or uneven to some degree. Therefore, you must not only develop the mechanical skill to perform correct slope operations, but you must also learn and observe all safety considerations.

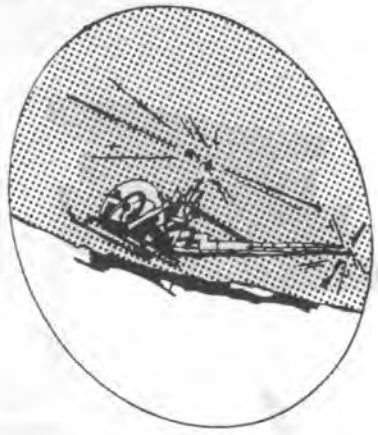
When a helicopter hovers over a flat, smooth surface, the skids of the helicopter are three feet above the ground. The tail rotor and main rotor are high enough above the ground so that there is no danger of striking the rotor system and causing an anti-torque failure and loss of control.



NEVER TURN THE TAIL UPSLOPE



CORRECT



AVOID

Hovering over uneven terrain, however, has some built-in dangers that you must be aware of before you can safely attempt a landing in such an area.

It is possible, for instance, for the skids of the helicopter to be at a height of 3 feet, while the arc of the tail rotor is only inches away from the ground. This would be the case if the tail of the aircraft were turned upslope. If an attempt were made to land the helicopter with the tail upslope an accident would be inevitable.

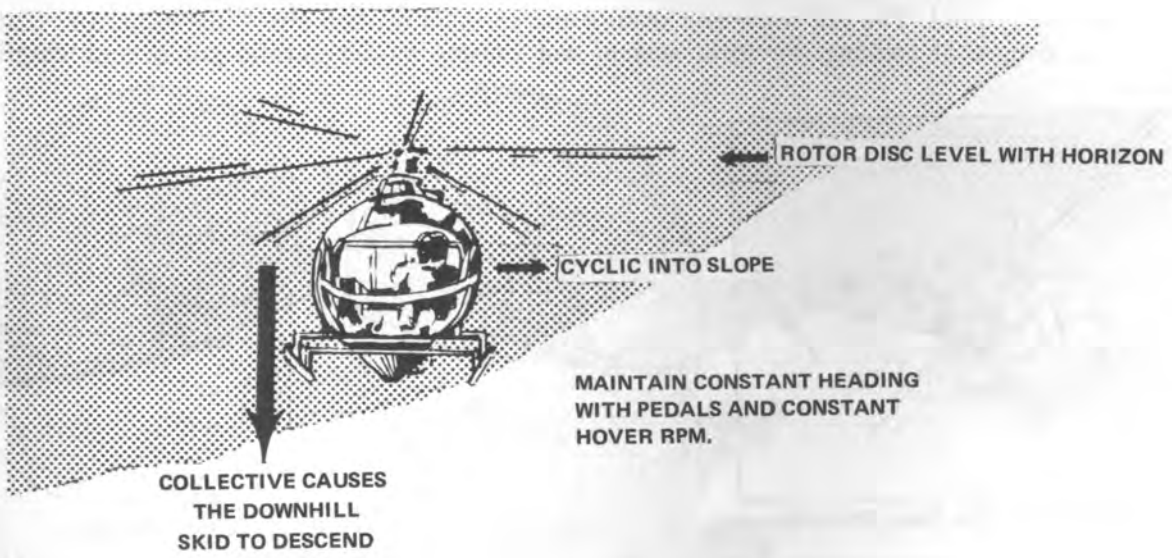
Landing with the nose pointed upslope is equally dangerous. Although the tail rotor is farther away from the slope while hovering, when the actual landing is made, the tail would be very near the ground. While this situation is not quite as dangerous as landing with the tail upslope, it should be avoided whenever possible.

The remaining alternative is to land the helicopter cross-slope. Although the control technique for landing in this manner is somewhat more complicated, it is by far the safest method.

ANSWER: a. laterally at an angle of 45-90 degrees with the skids parallel to the slope.

FRAME 3

Lowering the collective will cause the downslope skid to descend while applying cyclic pressure toward the upward side of the slope and will keep the uphill skid in place.



1. What controls are used to hold the helicopter in a level attitude with the upslope skid on the ground?

   a. Cyclic only.
   b. Pedals and collective.
   c. Cyclic and collective.
   d. Collective only.

2. What control(s) do you use to cause the downslope skid tc descend?

   a. Cyclic.
   b. Pedals.
   c. Collective.
   d. a & c.

FRAME 1 continued

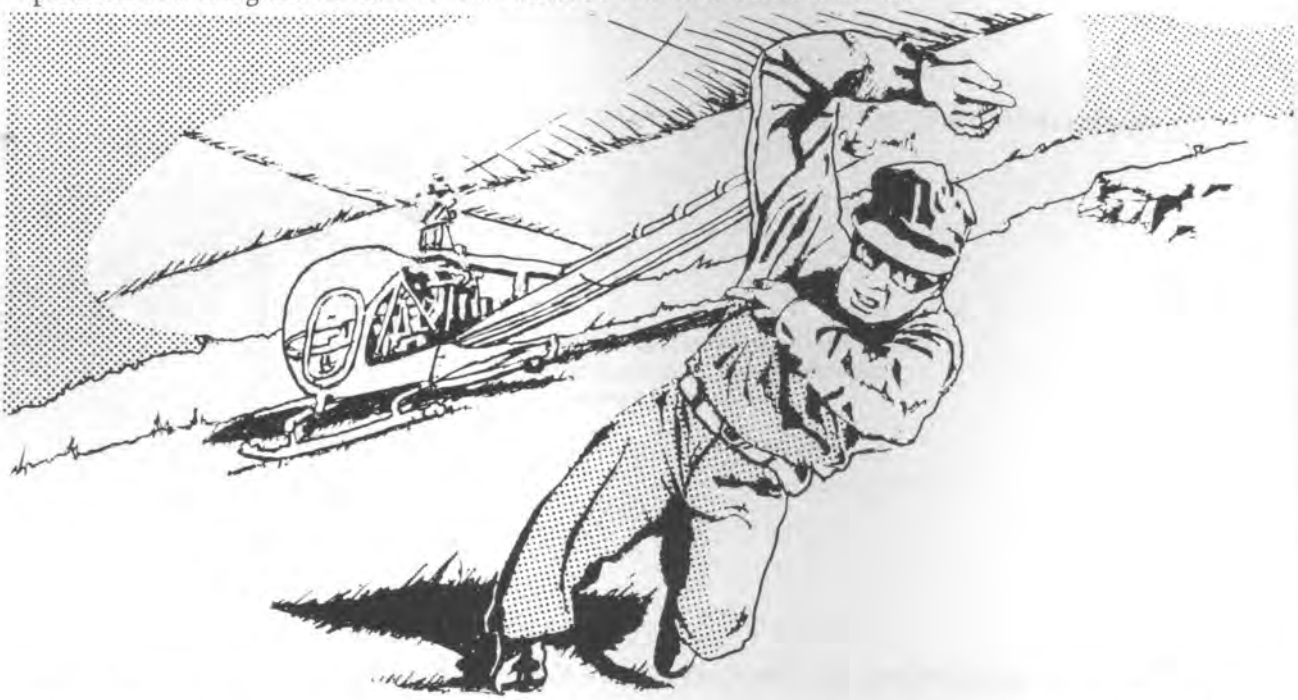
The helicopter with skid-type gear should always be landed cross-slope to

a. avoid striking the tail rotor on the ground.
b. avoid damage to the skids.
c. prevent the helicopter from turning.
d. avoid the main rotor from flexing and striking the tail boom.

ANSWER: 1. c. Cyclic and collective.
2. c. Collective.

FRAME 4

After the collective is fully lowered, move the cyclic fore, aft, and laterally to insure that the helicopter is firmly on the ground. These movements should be small and smooth. If the helicopter begins to tip over at any time during the slope operation, discontinue the landing operation and bring the aircraft to level attitude and take off to a hover.

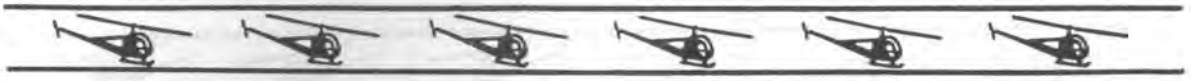


CAUTION: If it is necessary to leave the aircraft after the slope landing, do not walk uphill under the main rotor. As you can see from the accompanying diagram, the upslope side of the rotor disc is much closer to the ground than it is on flat terrain operations, therefore a definite danger exists of the pilot being struck by the rotating blades.

To complete the slope landing, once the downhill skid has made ground contact, you should smoothly

a. lower the collective to the full down position, while holding the cyclic into the slope.
b. move the cyclic in the direction of the downhill skid, while gradually reducing RPM to idle setting.
c. reduce the RPM while holding the aircraft into the slope with your cyclic.
d. move the pedals back and forth to insure that the uphill skid is firmly fixed on the ground, simultaneously reducing RPM.

ANSWER: a. avoid striking the tail rotor on the ground.



FRAME 2

There are also limitations to be observed if the helicopter is to be landed cross-slope. If these precautions are not observed, cross-slope landings could be as dangerous as upslope or downslope landings.

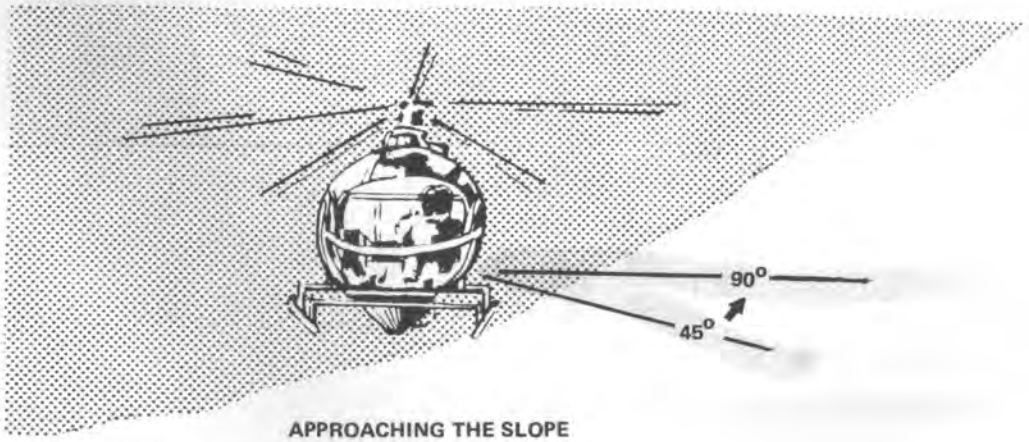
Since the helicopter will be landed cross-slope, you can see that there is a possibility of the helicopter tipping over and rolling down the slope. To avoid this situation, the maximum degree of slope a training helicopter can safely be landed on is limited to 8 degrees. When you hover toward the slope to begin the landing, remember the tail of the helicopter. Hover sideways with the skids of the aircraft 3 feet above the ground and parallel to the slope.

This method will insure that there is always adequate clearance for the main and tail rotor systems.

To begin the slope operation, hover the aircraft laterally, at an angle between 45-90 degrees, with the skids parallel to the slope.

This will insure that the tail is not turned upslope and affort the student a look at the intended touchdown point.

Hover the aircraft at 3 feet above the selected touchdown point. Maintain a constant heading and hover RPM.



APPROACHING THE SLOPE

To initiate a slope landing, the correct procedure is to hover

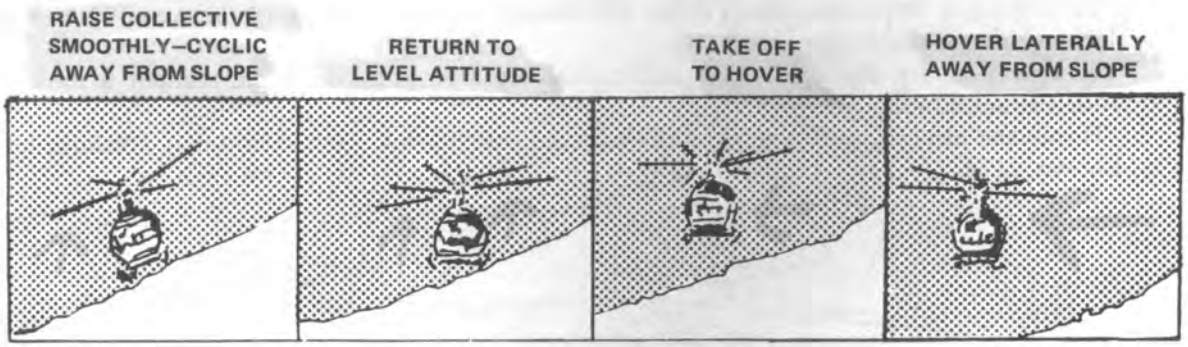
a. laterally at an angle of 45-90 degrees with the skids parallel to the slope.
b. directly to the slope, keeping the nose up hill to insure that you do not get a tail rotor strike.
c. at 45-90 degrees to the slope, with the nose toward the slope to insure that the tail rotor does not strike the ground.
d. directly to the slope, straddling the slope to insure that the aircraft sets down level.

RETURN TO PAGE 22 FOR FRAME 3

ANSWER: a. smoothly lower the collective to the full down position, while holding the cyclic into the slope.

FRAME 5

The takeoff from a slope is literally a reverse of sequence from the landing. Smoothly raise the collective pitch maintaining hover RPM and constant heading. As the downslope skid begins to ascend, move the cyclic away from the slope. This will return the helicopter to a level attitude with only the upslope skid in ground contact. From this point make a normal takeoff to a three foot hover and move away from the slope laterally.



As the downslope skid begins to rise, move the cyclic

a. rearward.
b. forward.
c. away from the slope.
d. toward the slope.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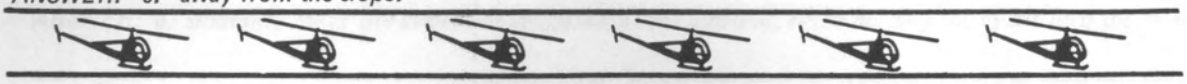
ANSWER: c. away from the slope.



PROCEED TO SELF-EVALUATION PAGE 29

SELF EVALUATION EXERCISE

1. What is the purpose of the slope operation?

   a. To learn to land in rice paddies.
   b. To learn to land on inclined or uneven areas.
   c. To learn to land on aircraft carriers.

2. The upslope skid is held in a stationary position on the slope by using the

   a. collective.
   b. cyclic.
   c. pedals.
   d. throttle.

3. Helicopters with skid-type landing gear should always be landed

   a. cross-slope.
   b. upslope.
   c. downslope.
   d. midslope.

4. The correct procedure for approaching the slope to land is

   a. always hover directly into the wind.
   b. hover laterally with skids parallel to the slope.
   c. the most expeditious means.
   d. perpendicular to the slope keeping the tail rotor away from the slope.

5. As the upslope skid touches the ground, you should

   a. lower the collective.
   b. apply cyclic into the slope.
   c. lower the collective slightly and apply cyclic into the slope.
   d. lower the collective slightly and apply cyclic downslope.

6. If you notice the helicopter beginning to tip over during the slope landing, you should

   a. push the collective full down as soon as possible.
   b. push full cyclic into the slope.
   c. smoothly bring the helicopter back to a level attitude and make a normal takeoff to a hover.

7. After departing a helicopter that has landed on a slope, you should always

   a. walk upslope.
   b. walk downslope.
   c. Either way is correct.
   d. towards the tail.

8. The takeoff from a slope is

   a. a reversal of the landing sequence.
   b. made by applying cyclic down the slope.
   c. made by applying upward collective and cyclic into the slope.

9. The actual slope landing is made

   a. from a stabilized 3 foot hover.
   b. only on the right skid.
   c. with the tail upslope.
   d. with the tail downslope.

10. You should maintain a constant heading during the slope takeoff and landing in order to

    a. increase your field of vision.
    b. prevent the tail from turning upslope.
    c. prevent the helicopter from tipping over.

11. The greatest potential danger(s) involved in allowing the tail rotor to turn upslope is

    a. damage to the blades.
    b. damage to the tail boom.
    c. anti-torque failure.
    d. All of the above.

12. The maximum degree of slope for safe slope operations should not exceed

    a. 6 degrees.
    b. 8 degrees.
    c. 10 degrees.
    d. 12 degrees.

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ANSWERS TO SELF EVALUATION EXERCISE

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