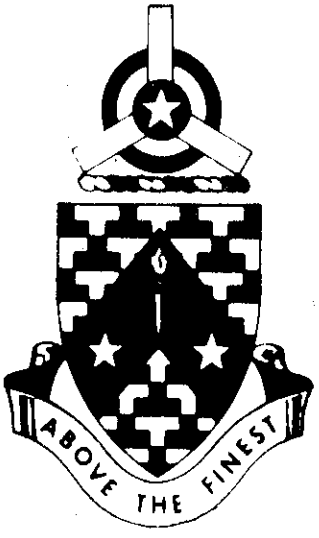
PROGRAMED TEXT

STRAIGHT AND LEVEL FLIGHT

AM-36



MARCH 1969

UNITED STATES ARMY
PRIMARY HELICOPTER SCHOOL
FORT WOLTERS, TEXAS

PROGRAMED TEXT

PROGRAM TEXT

FILE NO: AM-36

PROGRAM TITLE STRAIGHT AND LEVEL FLIGHT

POI SCOPE:

The identification of responses obtained from flight controls and flight procedures used to maintain straight and level flight.

INSTRUCTOR REFERENCES:

Helicopter Primary Flight Training Manual
1 March 1968

PREPARED BY:

LTC Jerry A. Simmons
Maint/Met Div

DATE: May 1968

REVISED BY:

CW2 Lance
Airmanship Div

DATE: March 1969

APPROVED BY:

for: DONALD J. LEWIS
LTC, SC
Chief, OCD

DATE: March 1969

TABLE OF CONTENTS

PROGRAMED CONFERENCE
FILE NO: AM-36

PROGRAM TITLE:
Straight and Level Flight

PREFACE

This program is designed to teach you the response obtained from the three (3) basic flight controls and to develop a thorough understanding of procedures used in flying a helicopter straight and level.

Read and analyze the instructional information carefully. Select an answer, then turn the page. The correct response will be shown at the top of the next page. If you selected the correct answer, continue on. If you chose a wrong answer, turn back and study the information again. If, after further study, you are still unable to arrive at the correct answer, ask the instructor for assistance.

This program is supplemented by Fort Wolters ETV Flight Training Film, Straight and Level Flight.

PERFORMANCE OBJECTIVES

1. Describe the response obtained from the three flight controls.
2. Establish a relationship between reference points on the helicopter and the horizon.
3. Determine the approximate airspeed by the attitude of the helicopter.
4. Identify the need to use pedals in maintaining a heading.
5. Identify the relationship between collective pitch and the throttle for maintaining RPM.

FRAME 1

The method of controlling the helicopter's vertical flight is through the use of the collective pitch control stick. This control is located at the pilot's left side in the cockpit. The collective pitch control varies the lift of the main rotor by increasing or decreasing the pitch of the main rotor blades simultaneously and to the same degree. Raising the collective pitch control stick increases the pitch of the main rotor blades, thereby increasing the lift. Lowering the control decreases the pitch of the blades, causing a decrease in lift and establishing a corresponding rate of descent.

The collective pitch controls the:

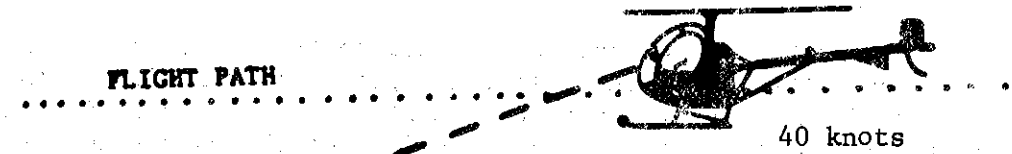
____a. horizontal direction of the helicopter.

__✓__b. vertical movement of the helicopter.

____c. the tilt of the main rotor mast.

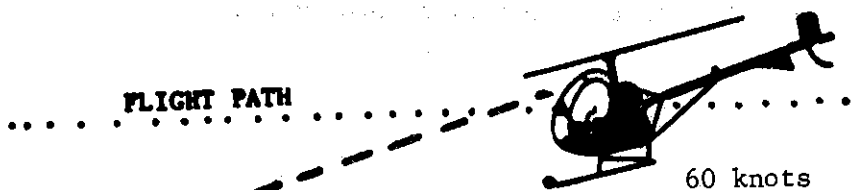
TURN TO PAGE 3 FOR FRAME 2.

FRAME 9 (continued)



To obtain a level flight attitude at 50 knots, the fixed reference point on the helicopter must be aligned beyond the horizon.

This is accomplished by moving the cyclic control forward, aft, right, or left.

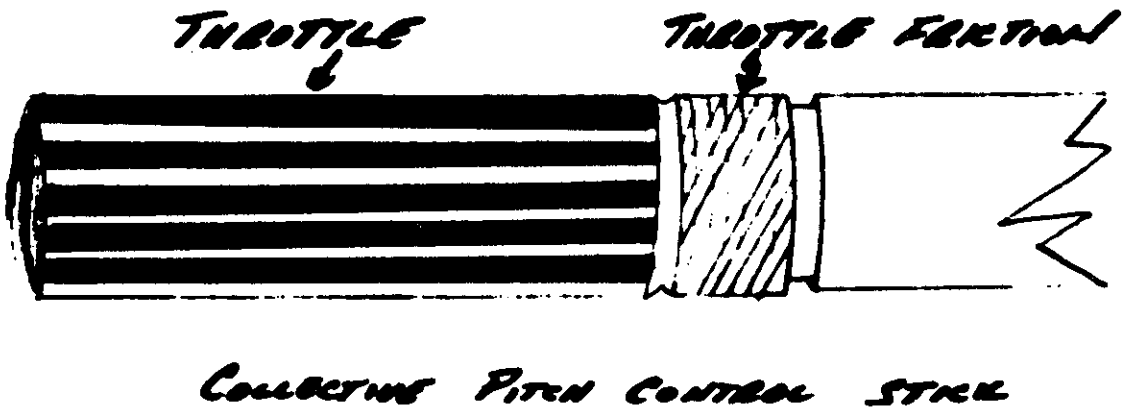


The fixed reference point must be raised toward by the application of aft cyclic to obtain a 50 knot level flight attitude.

ANSWER: b. vertical movement of the helicopter.

FRAME 2

Attached to the collective pitch control stick is the motorcycle grip type throttle, and a throttle friction device.



By manipulating the throttle control, the pilot can maintain a constant engine speed regardless of the increase or decrease in blade pitch.

To increase the lift generated by the main rotor blades, you would

(a) raise the collective pitch control stick.
b. lower the collective control stick.

ANSWER: a. lowered - forward
b. raised - aft (rearward)

FRAME 10

The airspeed of a helicopter is determined by its attitude.

You are flying straight and level at 50 knots. While scanning the instruments, you notice an airspeed increase of 10 knots and a loss of altitude with no change in power.

An increase in airspeed and a loss of altitude indicates you are flying in a nose low attitude. To return to straight and level flight would require a slight application of aft cyclic.
(high/low) (forward/aft)

Answer: a. raise the collective pitch control stick.

FRAME 3

The throttle is mounted on the collective pitch control stick and is operated by rotating the grip. It is synchronized with the main rotor pitch control in such a manner that an increase of pitch increases power and a decrease in pitch decreases power. Finer adjustments in power settings necessitated by maneuvers are made by the pilot rotating the throttle grip which will transmit additional movement to the carburetor throttle lever. By raising the collective pitch stick you are causing three things to happen:

(1) more lift is applied to the rotor system.

(2) manifold pressure is increased.

(3) the throttle is increased.

Lowering of the collective pitch control stick will cause the following results:

a less pitch

b lowering manifold press

c less throttle

ANSWER: low
aft

FRAME 11

Level flight attitude is maintained by visually checking the relationship of objects in the cockpit with the horizon.

Attitude corrections are made by moving the cyclic aft, right, and left forward.

ANSWER: a. decrease of lift.
b. decrease in manifold pressure.
c. decrease in throttle.

FRAME 4

The cyclic control stick is used to control movement of the helicopter along its lateral and longitudinal axes, or simply control the horizontal movement over the ground. When the cyclic control stick is moved forward the main rotor disc tilts forward. This, coupled with proper application of collective pitch and throttle produces forward flight.

When the cyclic control stick is moved to the rear, the

a. main rotor disc tilts forward and causes forward flight.
b. main rotor disc tilts aft and causes rearward flight.

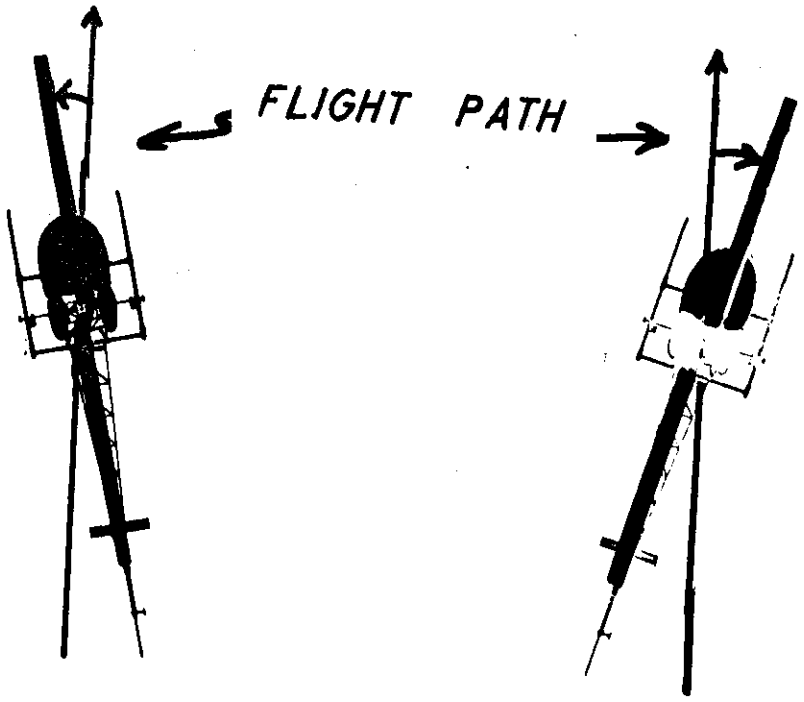
When the cyclic control stick is moved to the left, the

a. main rotor disc tilts to the right and causes the aircraft to move to the right.
b. main rotor disc tilts to the left and causes the aircraft to move to the left.

ANSWER: left, right, fore, and aft.

FRAME 12

The pedals control yaw and keep the longitudinal axis (heading) of the aircraft aligned in flight. They require very little adjusting in straight and level flight, but must always be used as power is increased or decreased.



A B

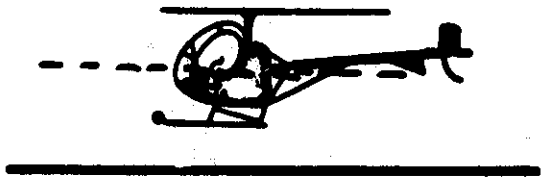
Figure A requires applying pressure to the right (right/left) pedal to counteract the yaw caused by decreasing power.

Figure B requires an application of pressure to the left (right/left) pedal in order to counteract the yaw caused by decreasing (increasing/decreasing) power.

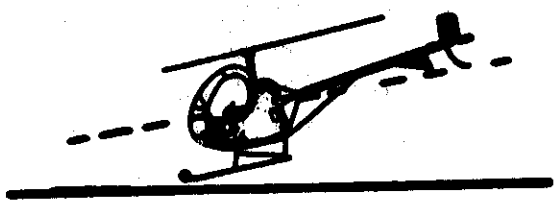
ANSWER: b. main rotor disc tilts aft and causes rearward flight.
b. main rotor disc tilts to the left and causes the aircraft to move to the left.

FRAME 5

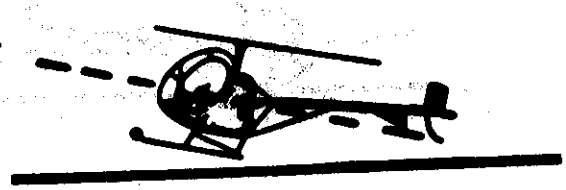
When the cyclic is moved from the neutral position, the attitude of the helicopter changes.

1. 

Cyclic in the neutral position

2. 

To obtain this attitude, the cyclic would be in a forward position.

3. 

The cyclic would in a/an aft position.

Answer: a. right b. left - increasing

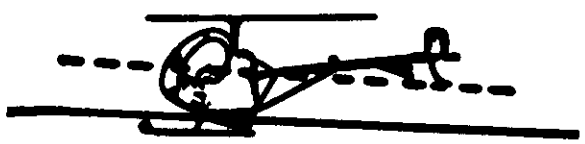
FRAME 13

Collective pitch is used to control vertical movement of the helicopter or to simply control altitude.

To gain altitude apply upward pressure an the collective. To lose altitude apply downward pressure.

1. To return to your desired altitude would require upward pressure on the collective pitch.

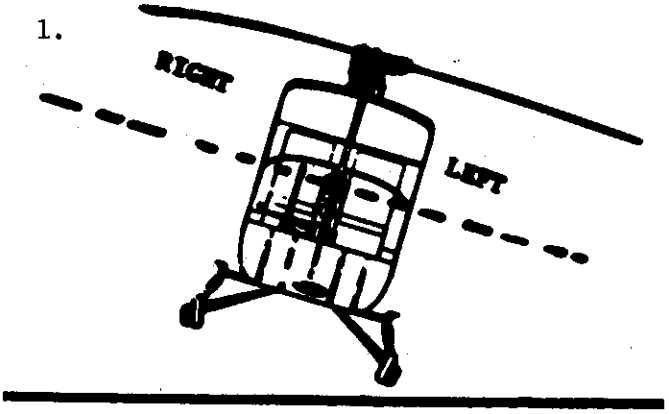
2. To return to your desired flight altitude would require downward pressure on the collective pitch.



ANSWER: forward
aft or rear

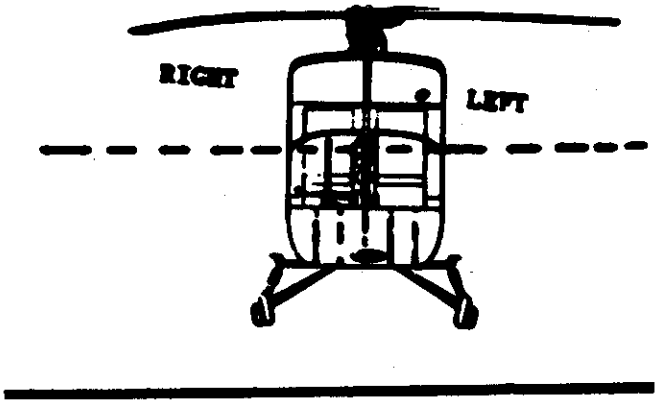
FRAME 6

1.



This attitude indicates the cyclic is to the left.
To return to level flight, the cyclic would have to be moved to the right.

2.



In order to turn to the right, the cyclic would have to be moved to the right.

ANSWER: applying upward pressure
applying downward pressure

FRAME 14

The pilot coordinates the throttle with the collective pitch to maintain a constant operation RPM.

Lowering the collective pitch decreases the pitch of the main rotor blades. The extra power available to drive the main rotor causes an RPM increase.

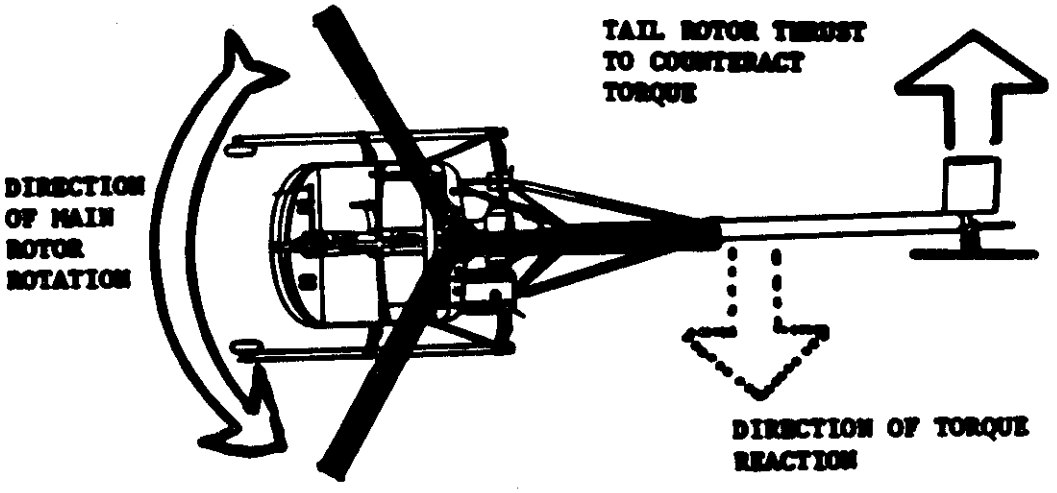
Increasing the throttle without increasing the pitch of the main rotor blades causes an RPM increase.

In order to maintain a constant RPM while lowering the collective pitch would require reducing throttle power.

ANSWER: left - right or neutral position.
right.

FRAME 7

In a single rotor helicopter, the main rotor causes an action called torque reaction. The reaction is an example of Newton's Third Law of Physics: "For every action there is an equal and opposite reaction." To counteract torque in an helicopter, the tail rotor is installed as an anti-torque device, and is controlled by the anti-torque pedals, our third primary flight control.



The purpose of the tail rotor is to

a. counteract torque.
b. provide torque.

ANSWER: increase:
decreasing

FRAME 15

Raising the collective pitch increases the pitch of the main rotor blades and causes a decrease in RPM.

Decreasing the throttle (power) will cause a decrease in RPM.

To maintain a constant RPM while raising the collective pitch requires increasing power.

NOTE: Remember, a certain amount of synchronization has been designed into the helicopter to assist you in maintaining a constant RPM while making pitch changes, therefore, the throttle changes should be very small and smoothly performed to prevent overcontrolling.

ANSWER: a. counteract torque

FRAME 8

The tail rotor pedals counteract torque in flight, provide directional control at a hover or in hovering flight.

An increase of engine power causes the helicopter to yaw to the right. This requires increasing pressure on the left pedal to counteract adverse yaw caused by increased torque.

Conversely, the decrease of engine power causes the helicopter to yaw to the left. This requires right pedal pressure on the right pedal to compensate for the decrease of torque.

ANSWER: decrease
increasing

FRAME 16

The manifold pressure gauge is your index of the engine power being used.

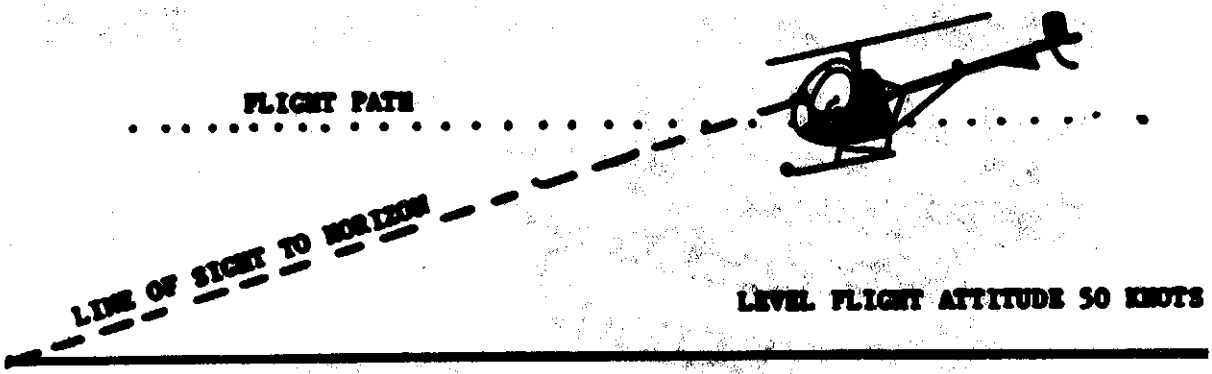
When the collective pitch is lowered and you have made the proper power adjustments to maintain a constant RPM, the manifold pressure gauge will read _____.
(higher/lower)

When the collective pitch is raised and power adjustments have been made to maintain a constant RPM, the manifold pressure gauge will read _____.
(higher/lower)

ANSWER: increasing

FRAME 9

Straight and level flight is flight in which a constant altitude, attitude, and direction are maintained.

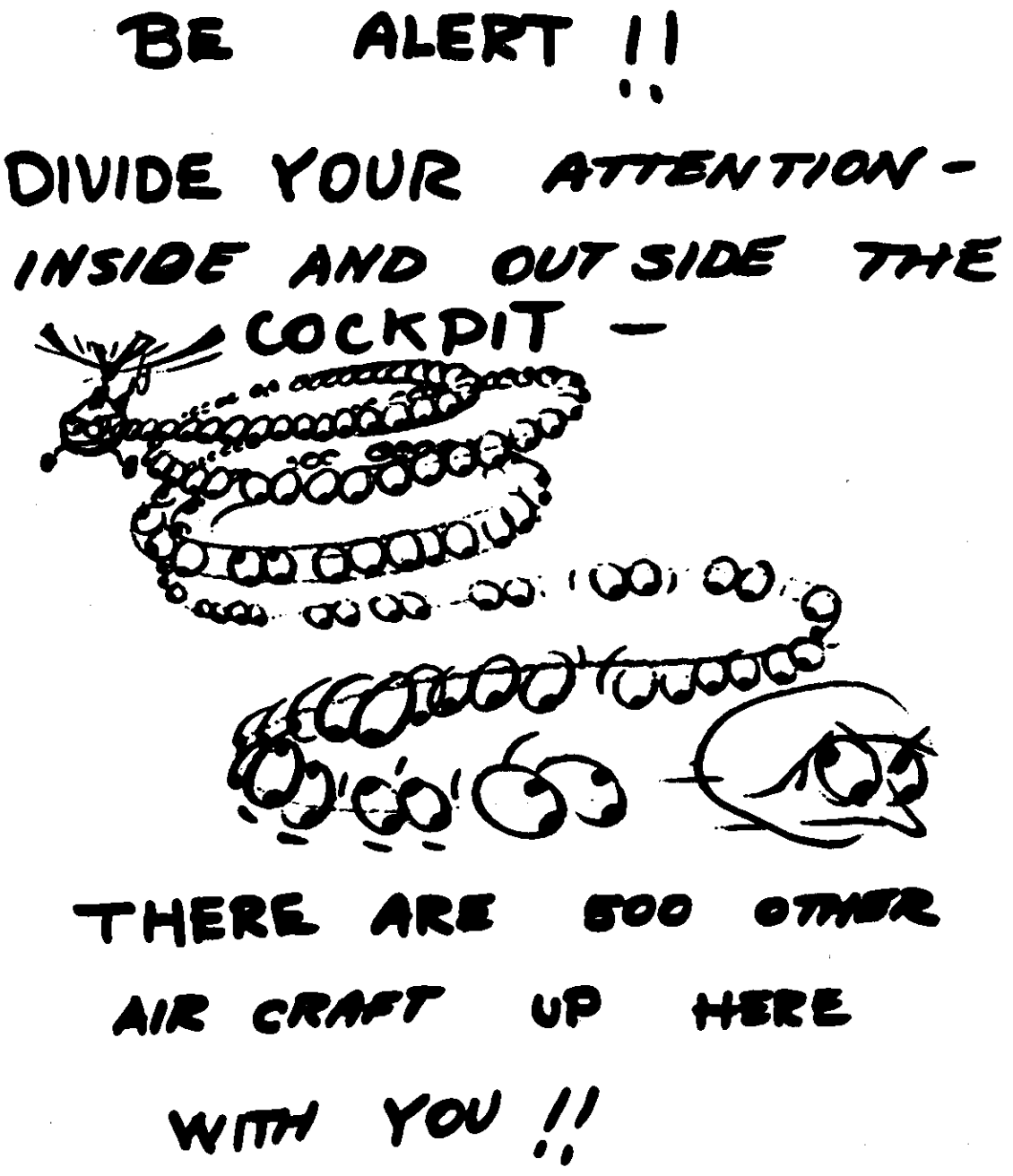


Level flight is obtained by fixing a relationship between reference points on the helicopter and the horizon.

NOTE: The position of fixed reference points on the helicopter will vary with individuals, but once established you can accurately judge the attitude of the helicopter.

STOP! TURN BACK TO PAGE 2 FOR THE CONTINUATION OF FRAME 9

ANSWER: lower
higher



SELF EVALUATION EXERCISE

1. The collective pitch controls

   a. horizontal movement.
   b. vertical movement.
   c. engine RPM.

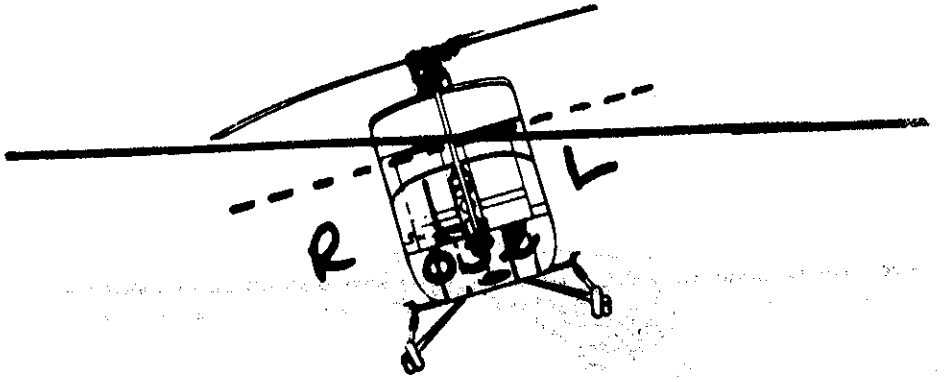
2. The cyclic control stick is used to control

   a. horizontal movement over the ground.
   b. vertical movement of the helicopter.
   c. vertical and horizontal movement.

3. An increase of power (throttle)

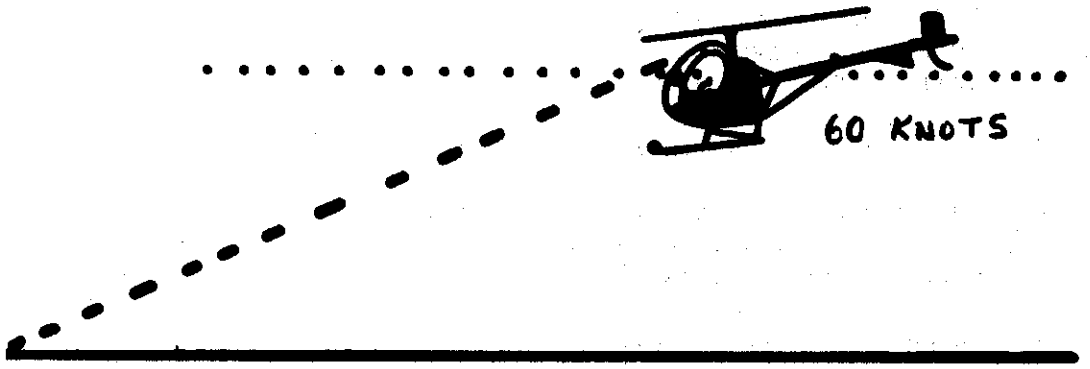
   a. necessitates applying right pedal to compensate for torque.
   b. requires applying left pedal to compensate for torque.

4. To return to level flight requires



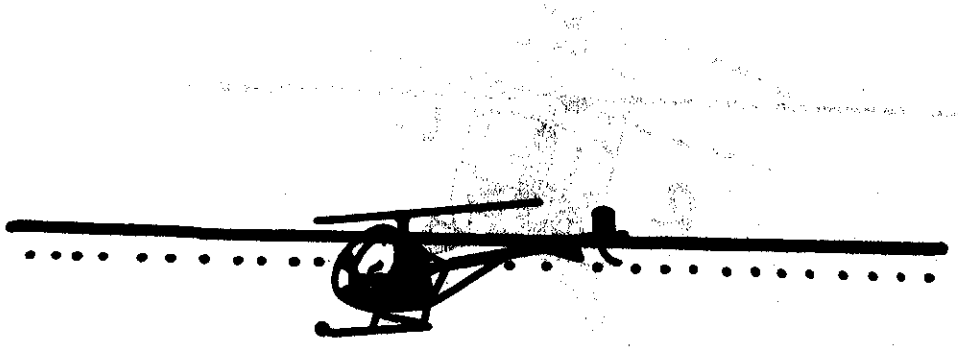
   a. moving the cyclic control stick right with a simultaneous application of right pedal.
   b. moving the cyclic control stick to the right.
   c. moving the cyclic control stick to the left.
   d. lowering the collective pitch control.

5. A 50 knot level flight attitude would be obtained by



a. applying collective pitch to raise the nose of the helicopter.
b. applying forward cyclic.
c. raising the nose with aft cyclic.

6. The recommended procedure for correcting the altitude while flying straight and level would be to



a. make a cyclic climb by applying aft cyclic.
b. lower the collective pitch control and apply aft cyclic.
c. increase collective pitch until the desired altitude is reached.

7. While flying straight and level at 50 knots, you observed a decrease in airspeed and an increase of altitude. To return to straight and level flight at your original altitude would require

   a. decreasing collective pitch.
   b. applying forward cyclic and decreasing collective pitch.
   c. an application of forward cyclic and increasing collective pitch.

8. To keep the helicopter aligned with a desired flight path while decreasing power requires an application of

   a. right pedal.
   b. left pedal.
   c. no pedal movement is required.

9. In order to maintain a constant RPM while increasing collective pitch in straight and level flight requires

   a. no throttle changes because the engine is synchronized.
   b. very small throttle changes because a certain amount of synchronization is designed into the throttle system.
   c. decreasing power.

ANSWERS TO SELF EVALUATION EXERCISE

1. b
2. a
3. b
4. c
5. c
6. c
7. b
8. a
9. b