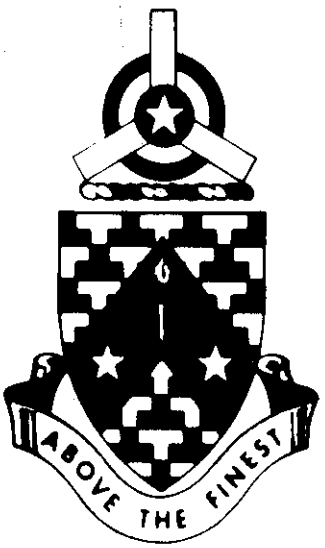
PROGRAMED TEXT

AUTOROTATIONS
PART 1

AM-43



FEBRUARY 1969

UNITED STATES ARMY
PRIMARY HELICOPTER SCHOOL
FORT WOLTERS, TEXAS

PROGRAMED TEXT

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FILE NO: AM-43 Part 1

PROGRAM TITLE
AUTOROTATIONS

POI SCOPE: Explanation of procedures involved in executing straight-in and 180 degree autorotations.

INSTRUCTOR REFERENCES: Helicopter Primary Flight Training Manual, USAPHS, Fort Wolters, Texas.

Fort Wolters Training Films HS-9, Autorotations OH-23D; and HS-3, Autorotations TH-55A.

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PREFACE

This program and the ETV film are designed to enable you to become familiar with the procedures involved in executing straight in and 180 degree autorotations. The proper application of these procedures will enable you to become highly proficient in autorotations.

Start with frame 1 and work each frame in succession. Each frame will usually ask you a question. The correct answer is printed on the top of the next frame. If you were incorrect, turn back and restudy the information before continuing on to the next frame. When you have finished the text, complete the self evaluation exercise. Now begin by studying the performance objectives on page iv.

PERFORMANCE OBJECTIVES

Upon completion of the program and without the aid of references, you will be able to:

1. Identify the initial entry requirements for straight-in autorotation.

2. Identify the initial entry control movements for a straight-in autorotation.

3. Identify aircraft attitude and control movements and instrument crosschecks during autorotative descent.

4. Identify the deceleration altitude, attitude, and control movements prior to and during touchdown.

5. Describe the purpose of a 180 degree autorotation.

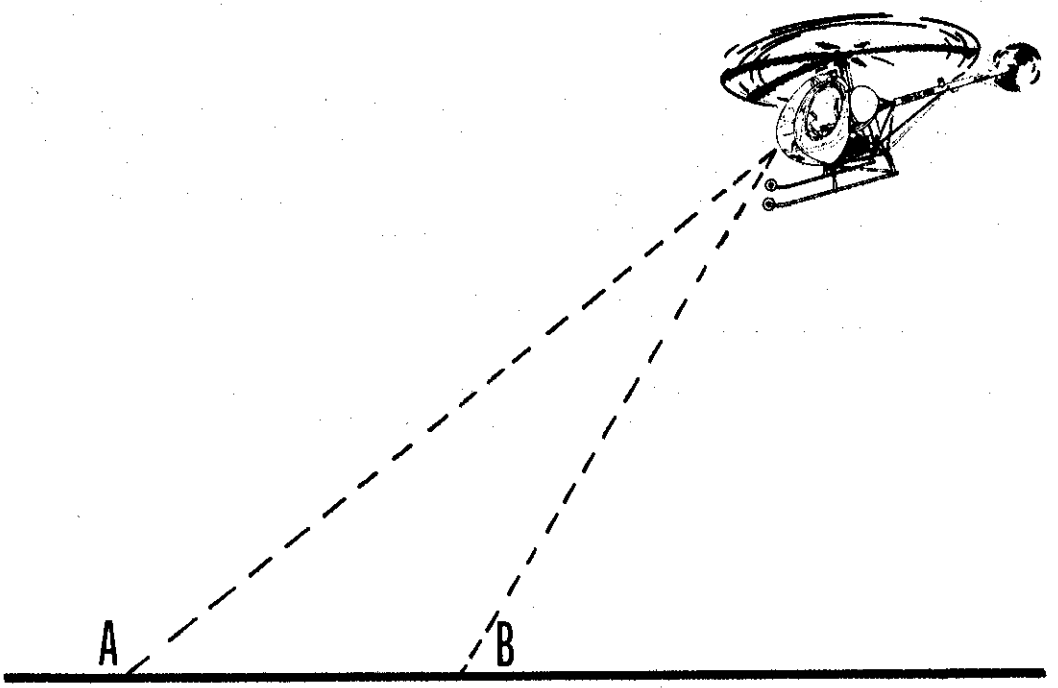
6. List the initial entry requirements and control movements for a 180 degree autorotation.

7. Identify aircraft attitude and control movements, and instrument crosschecks during 180 degree autorotative descent.

FRAME 1

Autorotation is a maneuver designed to develop the skill necessary to safely land the helicopter without engine power being delivered to the rotor system.

An autorotation is started by increasing to take-off RPM, while maintaining traffic pattern altitude and 50 knots of airspeed on base leg. The turn on final approach should be started so the aircraft will roll out on final aligned with the proper lane maintaining approach airspeed, altitude and RPM. If a crosswind exists establish a slip prior to entry, which will be maintained to the ground.



Which angle best depicts the autorotative glide path in a relatively strong headwind?

a. ⓑ —

TURN TO FRAME 2 PAGE 3

ANSWER: a. True. Caution should be used when landing with a strong crosswind from the left; since the right pedal loses effectiveness as RPM is decreased, you may not have sufficient right pedal to maintain aircraft heading during ground roll.

FRAME 5

180 DEGREE AUTOROTATIONS

A 180 degree autorotation is designed to develop coordination in making turns while in autorotation.

While practicing 180 degree autorotations the downwind leg should be flown closer to the lane because a helicopter has a higher rate of descent in an autorotative turn. Maintain 50 knots and correct for drift by crabbing if you have a crosswind. Begin your 180 degree autorotation when the helicopter is opposite the area where you intend to land.

If the direction of the crosswind is blowing you toward the field, the downwind leg should be flown

a. closer to the autorotation lane than normal.
b. further from the autorotation lane than normal.

TURN TO FRAME 6 PAGE 4

ANSWER: b. _X_ The greater the headwind velocity the steeper the autorotative glide angle.

FRAME 2

To INITIATE the AUTOROTATION -- The collective pitch is smoothly reduced to the full down position while maintaining operating engine RPM.

THEN -- When the collective is BOTTOMED:

1. Split the needles establishing the proper engine RPM for autorotation by decreasing the throttle.

2. At the same time apply right pedal to maintain aircraft heading with the lane.

3. Use the cyclic control to keep the aircraft aligned with the lane and establish a 45-50 knot autorotative attitude.

While in autorotation what control is used to prevent a possible rotor overspeed.

a. Left pedal
b. Throttle
c. Cyclic
d. Collective pitch

ANSWER: b. further from the autorotation lane than normal

FRAME 6

Initiate the 180 degree autorotation as in a straight-in autorotation; smoothly lower the collective, split the needles and apply right pedal. Begin the turn by applying cyclic in the direction you wish to turn, and establish a 45-50 knot attitude. Check rotor RPM and call out "Rotor in the green". Do not use pedal to assist your turn.

The first half of the turn should be made

a. as soon as possible.
b. only after you have established your RPM and attitude.
c. slower than the last half.

The needles are split

a. prior to lowering the collective.
b. while lowering the collective.
c. after the collective is in the full down position.

ANSWER: d. Collective pitch. When the collective pitch is used to avoid a rotor overspeed, it must be returned to the full-down position before RPM has decreased below safe operating range.

FRAME 3

Upon entry into the autorotative glide a check must be made to insure rotor RPM is in the green. If it is, call out "Rotor in the green". If not, and the RPM is decreasing rapidly, make a power recovery. Several checks of rotor RPM should be made during the descent. Also alignment should be maintained with the cyclic, and heading with the pedal.

At approximately 100 feet, close the throttle if a safe landing is assured and the rotor is in the green. At approximately 35 to 50 feet (OH-13 and OH-23) or 25 feet (TH-55) decelerate until a definite slowing of the aircraft can be felt.

If, during a practice autorotation, a rapid decrease in rotor RPM occurs due to a mechanical malfunction and a power recovery must be made, what corrective action should be taken?

a. Autorotation should not be attempted for the remainder of the flight period.
b. Another autorotation should be attempted to insure the problem is not the tachometer.
c. Land as soon as possible.
d. None of the above.

ANSWER: a. as soon as possible as this will allow you time on the last half of the turn to vary the degree of bank in order to make your intended landing area.
c. roll off throttle after the collective pitch is in the full down position.

FRAME 7

During your turn continue to crosscheck the rotor RPM. You may have to increase collective pitch slightly to avoid a rotor overspeed. Maintain a 45-50 knot autorotative attitude throughout the turn. The turn should be completed at about 75 to 100 feet above the ground.

A nose low attitude during an autorotative turn will cause

a. slow rate of descent and increased airspeed.
b. high rate of descent and increased airspeed.

ANSWER: c. Land as soon as possible, your aircraft is obviously incapable of performing an autorotation, and is therefore unsafe to fly.

FRAME 4

About 10 to 15 feet (OH-23), 5 to 10 feet (OH-13) and 3 to 5 feet (TH-55) above the ground apply sufficient collective pitch to check and slow the rate of descent. As the helicopter slowly descends toward the ground, apply additional collective pitch to cushion the aircraft onto the ground and at the same time coordinate forward cyclic movement to level the skids from the decelerating attitude. As touchdown is made, hold the collective stationary. If braking action is required, collective pitch may be lowered as necessary.

Normally, additional right pedal is required after the deceleration due to a great reduction in the streamlining effect.

a. True
b. False

STOP TURN TO FRAME 5 PAGE 2

ANSWER: b. high rate of decent and increase airspeed. An attitude similar to that used in a straignt-in autorotation should be maintained in the turn as the airspeed indicator is subject to error in autorotative turns.

FRAME 8

At approximately 100 feet check the rotor RPM and again call out "Rotor in the green". If a safe landing is assured, completely close the throttle. If there is doubt, execute a power recovery and go around. The termination technique will be the same as for the straight in autorotation which has previously been covered.

At about 35-50 feet (OH-13 and OH-23) or 25 feet (TH-55)

a. execute a deceleration to slow rate of decent and ground speed.
b. apply collective pitch to slow rate of decent.
c. level the skids to make an even touchdown.

About 10 to 15 feet (OH-23), 5 to 10 feet (OH-13) and 3 to 5 feet (TH-55) above the ground, apply sufficient collective pitch to check and slow the rate of descent. As the helicopter slowly descends toward the ground

a. hold the collective and cyclic steady.
b. apply additional collective as necessary and use forward cyclic to level the skids.
c. hold the collective steady and use forward cyclic to level skids.
d. apply additional collective as necessary and hold the cyclic steady.

ANSWERS: a. execute a deceleration to slow rate of decent and ground speed.

b. apply additional collective as necessary and use forward cyclic to level the skids.

NOW TURN TO PAGE 10 AND COMPLETE THE SELF EVALUATION EXERCISE

AUTOROTATIONS
SELF EVALUATION EXERCISE

1. An autorotation is started by

   a. decreasing to cruise RPM, losing 200 feet of altitude and slowing to 40 knots on base leg.
   b. increasing to take-off RPM, on final approach, maintaining traffic pattern altitude, and maintaining 50 knots of airspeed.
   c. increasing to cruise RPM, losing 200 feet of altitude, and slowing to 40 knots on final approach.
   d. increasing to take-off RPM on base leg, maintain traffic pattern altitude, and maintaining 50 knots of airspeed.

2. To initiate an autorotation

   a. collective pitch is smoothly reduced while rolling off engine RPM, applying left pedal, and establishing a 40 knot attitude.
   b. collective pitch is smoothly reduced while maintaining operating engine RPM and alignment with the lane with the cyclic control.
   c. collective pitch is rapidly bottomed while increasing to cruise RPM, and maintain aircraft heading with the cyclic control.
   d. collective pitch as smoothly reduced while maintaining operating RPM, and aft cyclic to slow the aircraft to 35 knots.

3. Which of the following indicates the proper control responses?

   a. Collective control for rotor overspeed, cyclic for heading, and pedals for aircraft alignment and attitude.
   b. Cyclic for aircraft alignment and attitude, pedals for rotor overspeed, and collective for heading.
   c. Pedals for aircraft heading, cyclic for attitude and alignment and collective for rotor overspeed.
   d. Collective for heading, cyclic for alignment and attitude, and left pedal for rotor overspeed.

4. A check for rotor in the green should be made

   a. at least once after the initial pitch pull.
   b. only after moving the collective pitch smoothly to the full down position.
   c. only after moving aft cyclic to initiate the deceleration and a crosscheck throughout the remainder of the descent.
   d. after moving the collective pitch smoothly to the full down position and as a part of the crosscheck throughout the descent.

5. The proper procedure for executing the deceleration is

   a. at approximately 35 to 50 feet (OH-13 and OH-23) smoothly join the needles and execute a deceleration to stop the descent.
   b. at approximately 25 feet (TH-55) smoothly join the needles and execute a deceleration sufficiently to noticeably slow the descent.
   c. at approximately 100 feet smoothly roll off the throttle and at 35 to 50 feet (OH-13 and OH-23) and 25 feet (TH-55) execute a deceleration sufficient to noticeably slow the descent.
   d. at approximately 100 feet smoothly roll off the throttle and at 35 to 50 feet (OH-13 and OH-23) and 25 feet (TH-55) execute a deceleration to stop the descent.

6. The proper control movements prior and during touchdown are

   a. apply collective pitch to check and slow descent, forward cyclic to level skids, and additional collective pitch to cushion the aircraft on the ground.
   b. join the needles, apply collective pitch to check and slow descent and forward cyclic to cushion the aircraft on the ground.
   c. smoothly roll off throttle, apply collective pitch to check and slow descent, and aft cyclic to cushion the aircraft on the ground.
   d. apply collective pitch to check and slow descent, aft cyclic to level the skids, and additional collective pitch to cushion the aircraft on the ground.

7. While practicing a 180 degree autorotation the downwind leg should be flown

   a. further from the lane than a normal pattern at an altitude of 500 feet and 50 knots.
   b. closer to the lane than a normal pattern at an altitude of 500 feet and 50 knots.
   c. the same distance from the lane as a straight-in autorotation and at an altitude of 500 feet and 50 knots.
   d. closer to the lane than usual at an altitude of 300 feet at 45-50 knots.

8. In order to increase your rate of turn in a 180 degree autorotation to the left, you should

   a. apply left pedal and increase airspeed.
   b. apply additional cyclic to the left.
   c. apply additional cyclic to the left and use left pedal.
   d. apply left pedal and decrease airspeed.

9. The turn in a 180 degree autorotation should be <u>completed</u>

   a. approximately 200 feet above the ground.
   b. approximately 75 to 100 feet above the ground.
   c. just prior to beginning the initial collective pitch pull.
   d. approximately 35 to 50 feet (OH-13 and OH-23) or 25 feet (TH-55) above the ground.

ANSWERS TO SELF EVALUATION EXERCISE

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