

PRIVATE PILOT

VII. AREA OF OPERATION: NAVIGATION

A. TASK: PILOTAGE AND DEAD RECKONING

OBJECTIVE

To determine that the applicant:

1. Exhibits knowledge of the elements related to pilotage and dead reckoning.
2. Follows the preplanned course by reference to landmarks.
3. Identifies landmarks by relating surface features to chart symbols.
4. Navigates by means of pre-computed headings, groundspeeds and elapsed time.
5. Corrects for and records the difference between preflight groundspeed and heading calculations and those determined en route.
6. Verifies the airplane's position within three (3) nautical miles of the pre-planned route.
7. Arrives at the en route checkpoints within five (5) minutes of the initial or revised ETA and provides a destination estimate.
8. Maintains the appropriate altitude, +/-200 feet (60 meters), and headings, +/-15°.

ELEMENTS

1. Pilotage is navigation by reference to landmarks or checkpoints.
 - a. Can be used on any course that has adequate checkpoints.
 - b. Commonly used in conjunction with dead reckoning and VFR radio navigation.
 - c. The checkpoints selected should be prominent features such as towns, airports, water masses, unique geological features, etc.
 - d. Never place complete reliance on any single checkpoint.
 - e. Choose ample checkpoints for the airplane to be flown:
 - i. Consider airplane's groundspeed.
 - ii. Consider scale of sectional charts: 1" = ~8 sm = ~7 nm.
 - f. If a checkpoint is missed, look for the next one while maintaining heading.
 - g. Only well-traveled roads are shown on charts.
 - h. Some structures, like antennas, while tall, can be difficult to see.
 - i. Sometimes TV antennas are grouped together in an area near a town.
 - j. Never approach an area of antennas less than 500' above the tallest one.
 - k. Most tall structures are marked with strobe lights making them more visible to pilots.
 - l. Aeronautical charts display the best information available at the time of printing, but a pilot should be cautious for new structures or changes that have occurred since the chart was printed (6 months pass between updates). NOTAM's can be helpful in visualizing major changes to charts.
2. Dead reckoning is navigation solely by means of computations based on time, airspeed, distance, and direction.
 - a. Inputs are time, airspeed, distance and direction.
 - b. Inputs are adjusted for windspeed and wind direction.
 - c. Outputs are heading and groundspeed.
 - d. The predicted heading will guide the airplane along the intended path and the groundspeed will establish the time to arrive at each checkpoint.
 - e. Dead reckoning is usually used in conjunction with pilotage for cross-country flights.
 - f. The heading groundspeed as calculated are constantly monitored and corrected by pilotage as observed from checkpoints.
3. The wind triangle or vector analysis.
 - a. With no wind, true course (TC) = true heading (TH), and groundspeed (GS) = true airspeed (TAS).
 - b. With wind, TC and GS are found by the vector addition of wind velocity (speed and direction) and airplane velocity (TAS and TH).
 - c. This vector addition can be accomplished using a flight computer or a wind triangle.
 - d. A wind triangle is a graphic explanation of the effect of wind on flight.
 - e. Experienced pilots are so familiar with the wind triangle concept that the diagram can be visualized mentally to the accuracy needed for visual flight.

PRIVATE PILOT

VII. AREA OF OPERATION: NAVIGATION

A. TASK: PILOTAGE AND DEAD RECKONING

4. Definitions related to pilotage and dead reckoning:
 - a. True course (TC): Direction of the line connecting two desired points, drawn on the aeronautical chart and measured clockwise in degrees from true north.
 - b. Wind correction angle (WCA): Determined from the flight computer or wind triangle (added to TC if the wind is from the right, subtracted if the wind is from the left).
 - c. True heading (TH): The direction measured in degrees clockwise from true north, in which the nose of the airplane should point to fly the TC. $TH = TC \pm WCA$.
 - d. Variation (VAR): The difference in angle between the direction to the true North Pole and the magnetic North Pole. Obtained from the isogonic lines on an aeronautical chart (added to TH if west, subtracted from TH if east).
 - e. Magnetic heading (MH): The direction measured in degrees clockwise from magnetic north, in which the nose of the airplane should point to fly the TH. $MH = TH \pm VAR$.
 - f. Deviation (DEV): The difference between actual magnetic heading and the magnetic heading indicated on the compass resulting from interference by the airplane's structure and electromagnetic fields. Obtained from the deviation card on the airplane compass (usually compiled with radios on). "For 180°, steer 178°," $DEV = -2$.
 - g. Compass heading (CH): The reading on the compass (found by applying DEV to MH) to be followed to fly the TC. $CH = MH \pm DEV$.
 - h. Total distance: Obtained by measuring the length of the TC line on the aeronautical chart (using the scale at the bottom of the chart or a plotter).
 - i. Groundspeed: Obtained by measuring the length of the TC line on the wind triangle (using the scale employed for drawing the diagram).
 - j. Estimated time en route (ETE): Total distance divided by groundspeed.
 - k. Fuel rate: Predetermined gallons per hour used at cruising speed.

REFERENCES

1. AC 61-23 / FAA-H-8083-25, Pilot's Handbook of Aeronautical Knowledge, Chapter 14.