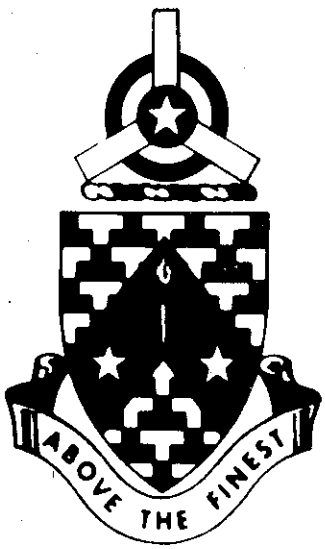
PROGRAMED TEXT

NAVIGATION
PRACTICAL EXERCISE II

AM-64



DECEMBER 1968

UNITED STATES ARMY
PRIMARY HELICOPTER SCHOOL
FORT WOLTERS, TEXAS

PROGRAMED TEXT

PROGRAM TEXT

FILE NO:

AM-64

PROGRAM TITLE

Navigation
Practical Exercise II

POI SCOPE:

Practical exercise involving all information presented in the navigation course

INSTRUCTOR REFERENCES:

TM 1-225

PREPARED BY:

MAJ Bruce J. Dubov
Flt Subj Br

DATE:

March 1968

REVISED BY:

CW2 J.B. Curtis
Primary I Br, Airmanship Div

DATE:

December 1968

APPROVED BY:

for Martin Hemmerce
DONALD J. LEWIS
LTC, Sig C
Director, OCD

DATE:

December 1968

TABLE OF CONTENTS

PROGRAMED TEXT **PROGRAM TITLE:**
FILE NO: AM-64 Navigation Practical Exercise II

CONTENTS	PAGE NUMBER
1. PREFACE	iii
2. PERFORMANCE OBJECTIVES	iv
3. PROGRAM	1
a.	
b.	
c.	
d.	
e.	
4. SELF EVALUATION EXERCISE	N/A
5. ANSWERS TO SELF EVALUATION EXERCISE	
6. ITEMS TO BE ISSUED WITH PROGRAM	
7.	
8. Students required to bring to Class:	
a. Plotter	
9. b. Dead Reckoning Computer	
c. Ruler	
d. DALLAS Sectional	
10.	

PREFACE

It is imperative that all aviators acquire the skills and knowledge necessary to enable them to accurately navigate their aircraft from one point to another, and to be able to locate their position along that route at any time.

This programed text has been designed to test the student's ability to solve the various types of problems encountered in any preflight or inflight situation.

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. Now begin by studying the performance objectives on page iv.

PERFORMANCE OBJECTIVES

Upon completion of this practical exercise, you will be able to apply the knowledge gained to actual flight planning and inflight situations.

During this period you will complete a practical exercise that will incorporate all of the navigation instruction that you have received. You will find the exercise a very good review of your navigation work. The problems you will solve are very similar to those encountered in any VFR flight.

You will need the following equipment to plan your flight:

Dallas Sectional
Weems Plotter
Ruler
Dead Reckoning Computer
Pencil

As soon as you assemble your equipment, turn to page 3 and begin working.

TURN TO PAGE 3

FRAME 3

You land at Jones Field, refuel, and depart at 1200 hours with orders to arrive at Majors Field at 1233. The wind is reported to be 180/20.

33 minutes 33 KM

Now lets solve the following problems.

12. What must your GS be 60 K?

13. What is your TAS 80 K?

14. What will be your IAS if you fly at 4,000 ft with a temperature of -10°C? 78 K

21 (KM) 23 min At 1210 you are over the town of Leonard, to the right of the course. and we have determined your winds to be from 075°/30K

155°

15. What TAS would you have to fly to be on time at Majors?

71 K. 157° IAS 69 K

When you have finished the last five problems, turn to page 4 and check your answers.

21 Km
23 min
155°
55 K

TURN TO PAGE 4

FRAME 1

You have been given the mission of flying from Majors Field (33° 04' N 96° 04' W) to Flying M Ranch (33° 11 1/2' N 96° 42 1/2' W) to Jones Field (33° 36 1/2' N 96° 11' W) and return to Majors Field. The preflight data given below is for the first leg of this flight only. Refueling arrangements have been made at Flying M Ranch.

The preflight data is as follows:

Wind:	305°/40K	I. Alt	4,000 feet
Fuel:	46 gal	Temp.	+10°C
R/C:	15 GPH	IAS	70K

With the above information you will be able to solve the following navigation problems. Be sure to work with a great deal of care and accuracy.

33.5 NM 283° -8

1. TAS 75 K
2. TC 287°
3. GS 36 K TH 295° -8 294° 8° E
4. MH 287
5. Distance 33.5 NM
6. ETE 56.5 565 in.
7. Fuel needed 14 Gal

If you took off at 0800 hours, and landed at the Flying M Ranch at 0849 hours, what was your actual ground speed?

8. GS 40.5 Kts

When you have finished these eight problems, turn to page 5

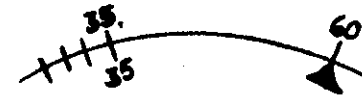
TURN TO PAGE 5

ANSWERS:

12. 60 Kts

This is another time, rate, and distance problem.

First place the distance (33NM) over the time allowed for the flight. Then just read the GS above the rate index.

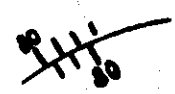


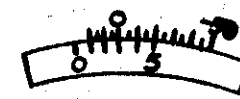
13. 80 Kts

This is just another simple problem figured on the wind face side of the computer. You will solve for TH and TAS, although you are only going to use the TAS. Since you are already given the winds (180/20K), and have figured out the GS in problem #12 (60Kts), all that is needed before you go to the computer is the TC. Carefully measuring with the plotter, your TC should be 170°. Then using the winds, TC and GS, you will find that the TAS, figured on the wind face side of the computer, is 80 Kts.

14. 78Kts

This problem is solved by utilizing the airspeed and density altitude computations window on the slide rule side of the computer. Set the altitude (4000 ft) in the window opposite the temperature of -10°C. Then, reading the TAS on the outer scale, read the IAS (78Kts) directly opposite it on the inner scale.





ANSWERS CONTINUED ON PAGE 6

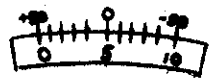
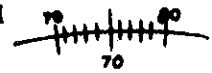
ANSWERS:

Now that you have finished the computations for the first leg, lets take a look at your answers. The tolerances are as follows:

Heading	± 1 Degree
Time	± 1 Minute
Distance	± 1 NM (SM)
Speed	± 1 Knot (MPH)
Rate	± .5 GPH (PPH)
Fuel	± 1 Gal (LB)

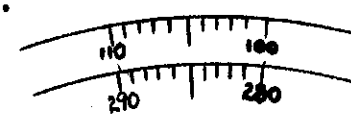
If any of your answers are not within the allowable tolerances, rework the problem in the question until you find the proper solution. Your instructor will assist you if necessary.

1. 75 Knots

The proper method of solving this problem is by utilizing the Airspeed and Density Altitude Computations window on the slide rule side of your computer. After setting the temperature (+10°) opposite the indicated altitude (4,000)  , read the indicated air speed (IAS) on the inner scale of your computer. Opposite the IAS, (70K) you now read the true air speed  , 75 Knots, on the outer scale.

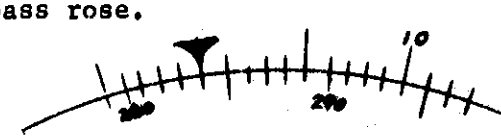
2. 284°

The true course, measured with your Weems Plotter along your intended path over the ground, is 284°. Remember to read from the lower to the higher number on the arc of your plotter. If you misread your plotter, you would probably read a true course of 296°.



3. 36K, 295°

Now that you have solved for TAS and TC, you can compute both TH and GS using the wind face side of the computer. You will first plot the wind (305°/40K). Next, rotate the compass rose until the TC is under the True Index. Next, slide the grid until the TAS (75K) is under the penciled dot. Now read the GS under the grommet: 36K . To find the true heading, count off the number of degrees between the center line and penciled dot. Then count off the same number of degrees (11° right) on the correction scale and read the TH (295°) on the compass rose.



ANSWERS CONTINUED ON PAGE 7

ANSWERS CONTINUED FROM PAGE 4

15. 69 Knots

There are several steps to solving this problem. First find the GS that you must make to be on time at Majors. Since the measured distance is 21 nautical miles and you have 23 minutes to get to Majors, a simple computation on the slide rule side of the computer tells you that the GS must be 55 Knots. Then measure the true course from Leonard to Majors (155°). Now turn to the wind face side of the computer and solve a TH, TAS problem, using the given winds of 085°/30Kts., a true course of 155°, and a GS of 55Kts. The answer will be a TH of 132°, and a TAS of 71 Kts. Disregard the TH and look at the TAS. The answer calls for IAS, not TAS. Simply turn the computer over and set the window up as you did in problem #14. Then read the TAS of 71 Kts on the outer scale, and the IAS (69Kts) will be directly beneath it.

After you have checked your answers and corrected any errors, turn to frame 4, page 8.

ANSWERS CONTINUED FROM PAGE 5

4. 287°

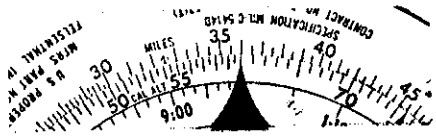
All you have to do to solve for magnetic heading is apply the variation to the true heading. In this case the variation is 8° east, so we will subtract the 8° from the TH of 295°, you get a MH of 287°.

5. 34 Nautical Miles

The distance is measured with the 1:500,000 scale on your plotter.

6. :57

This is a simple time, rate and distance problem that is solved on the slide rule side of the computer. First you place the ground speed (36K) over the rate index. Then locate the distance(34 NM) on the distance scale. Reading below the distance you find the answer - :57 minutes.

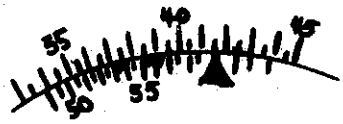


7. 14.2 gallons

You solve for this answer by working a simple fuel consumption problem on the slide rule side of the computer. After placing the rate of consumption (15 GPH) over the rate index, locate a time of :57 minutes (your ETE from problem #6) on the inner scale. Right over the time you will read 14.2 on the outer scale. This is how many gallons of fuel that you will need to fly for :57 minutes at a rate consumption of 15 GPH.

8. 41.5 Knots

This is another time, rate and distance problem. If you take off at 0800 hours, and land at 0849, you know that the flight took 49 minutes. Since you know the distance to be 34 NM, set the distance over the time and read the rate over the rate index.



Well, how did you do on those first eight questions? Try a few more while you do some preflight planning for the second leg of the flight. You will find the questions quite similar to those that you have already done.

Turn the page and get started on frame 2, page 9

FRAME 4

You are to make a flight from Webb AFB (32° 13' N 101° 31' W) to Lamesa (32° 45' N 101° 55'W) to Sweetwater (32° 28' N 100° 28' W) and return.

Preflight Data for first leg:

328

Wind: 270/10
Fuel: 270 lbs
I. Alt.: 4,500 ft
Temp.: +10°C
Rate of consumption: 75 PPH (pounds per hour)
Depart: 0815 Hours
Must arrive Lamesa at 0850 hours

37.5 Km
75.4 Km
55.5 Km

35 min

Find:

1. GS 64 K
2. TC 325°
3. TH 321° TAS 73 K
4. MH 310° -11
5. IAS 68 K
6. Fuel required for first leg (no reserve) 44 Pounds
7. You take off on schedule and at 0837 you are over the highway three nautical miles north east of Ackerly. What is your actual Ground Speed? 67 K

31 Km

8. What is the actual wind? _____
9. What IAS will you have to fly from your off course position to make good an arrival time of 0851 at Lamesa? _____

Now that you have completed the first leg, turn to page 10 and check your answers.

32

FRAME 2

After landing and refueling at the Flying M Ranch, you depart on the second leg at 1030 hours.

Additional data for the second leg is as follows:

Wind: 310/35
Fuel: 46 gal
R/C: 15 GPH

I. Alt: 2000 ft.
Temp: +15°C
IAS: 70 Kts → 72.5K

53°
36.5 KM

FIND:

9. TC 047° °

10. TH 18° ° GS 69 Kts 28.5°

11. MH 11° °

When you finish these problems, check your answers on page 11.

ANSWERS:

1. 64 Knots
Use slide rule side of computer - 37.5 NM in 35 minutes.

2. 328°
Measure carefully with plotter.

3. 321°, 71 Knots
Solve on wind face side of computer using winds (270/10), Ground Speed (64K) and True Course (328°).

4. 310°
Subtract Variation (11°E) from True Heading of 321°.

5. 66 Knots
Place temperature (+10°C) opposite I. Alt. in Airspeed Window: read TAS of 71 knots on outer scale and you will find the answer of 66 knots directly opposite the TAS.

6. 43.5 lbs
A flight of 35 minutes at a rate of 75PPH will use 43.5 lbs of fuel.

7. 57 Knots
(21 NM in 22 minutes)

8. 275°/24Kts
Track = 339° (measure with plotter)
GS = 57 Kts (problem #7)
TAS = 71 Kts (problem #3)
TH = 321° (problem #3)

9. 89 Knots
18 NM in 14 minutes will give you a GS of 77kts. Measure a TC of 314°. The wind is 275/24. Solving a TH, TAS problem, you will find the TAS to be 96Kts. Then turning to the slide rule side of the computer, find the IAS (I. Alt 4,500 and Temperature +10°C).

Turn to page 12 and start the second leg.

ANSWERS:

9. TC 047°

If you were more than 1° off in either direction, re-measure the true course.

10. TH 019°
GS 69K

This question is solved just like problem #3. Be very careful in your use of the computer.

11. Just subtract the variation of 8° (east) from the true heading of 019° and you will get the correct answer.

After you have checked your answers, and corrected any errors, turn to page 2, and plan for the third and final leg of your flight.

STOP. RETURN TO PAGE 2

FRAME 5.

You land at Lamesa and shut down. Without refueling you depart at 0910 on the second leg.

Preflight Data:
W/V320°/15K I Alt 3,500 ft
IAS 65K Temp +13°C

TC 103°
10° E
93°
-8
85°

Find:

10. TAS 69 K
11. MH 85°
12. GS 80 K
13. Dist. 75.5 KM
14. ETE 57
15. ETA 10:07

If you experience any difficulty while working these problems, raise your hand and the instructor will be glad to assist you.

After flying for 20 minutes your fuel gage reads 190 lbs. What is the average rate of consumption for both legs?

270
80
50
270
130
-70

16. R/C 86 PPH

17. You land at Sweetwater at 1005. How much fuel should be left in the tanks? 140 lbs.

18. You depart on the last leg of the flight, making no allowance for wind. What is your MH? 244° degrees.

When you have finished these questions, turn to page 14 and check your answers.

254
-10
244°

INTENTIONALLY LEFT BLANK

ANSWERS:

10. 69K

Use airspeed and Density Altitude Computations Window. Place +13°C over 3,500 ft. Reading opposite the IA (65K) on the inner scale, you will find the TAS (69K) on the outer scale.

11. 85°

First you must find the TH (95°) To do this utilize the wind (320/15). The TC 103° and TAS (69K). The answer found on the wind face side of the computer, is a TH of 95°. Just subtract the variation (10°E), and you will find the MH to be 85° (95°-10°).

12. 80 Kts.

When you solved for TH in the last problem, you should also find a GS of 80K.

13. 75 1/2 NM

Measure very carefully with the 1,500,000 scale of your weems plotter. You will find your answer to be 75 1/2 NM.

14. :57

At a GS of 80K, it will only take you :57 to fly 75 1/2 NM. (time, rate & distance)

15. 10:07 hours

Just add the ETE of 57 minutes to the departure time of 0910 hours.

16. 86 PPH

Your first leg took 36 minutes; add this to the 20 minutes flown on the second leg, giving you a total time flown of 56 minutes. If there are 190 lbs of fuel left, you used 80 lbs (270-190) in these 56 minutes. Using the slide rule side of the computer, place 80 (lbs) over 56 (minutes) and your rate index will point at the average rate of consumption (86 PPH).

17. 140 lbs.

First leg 36 minutes
Second leg 55 minutes
Total 1:31 minutes

Using a rate of consumption of 86 PPH (problem #16) and a time flown of 1:31, you will find that 130 lbs of fuel have been consumed. Just subtract this from the 270 lbs that you had when you started your flight (270-130).

18. 244°

TC $\pm$ DC = TH $\pm$ Var = MH

255° 0 = 255° - 11°E = 244°

L2516 Army-Ft. Sill, Okla.