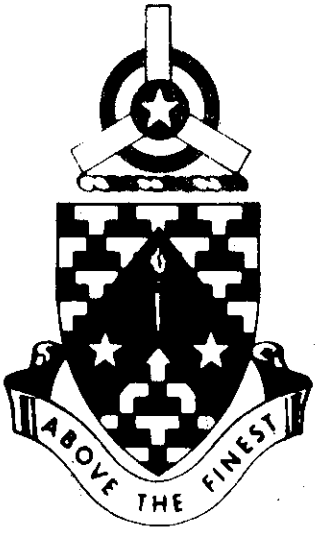
PROGRAMED TEXT

NAVIGATION COMPUTER

AM-61



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UNITED STATES ARMY
PRIMARY HELICOPTER SCHOOL
FORT WOLTERS, TEXAS

PROGRAMED TEXT

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FILE NO: AM-61

PROGRAM TITLE Navigational Computer (Slide Rule)

POI SCOPE: Introduction and proper use of the slide rule side of the computer.

INSTRUCTOR REFERENCES:

TM 1-225, Ch. 8, Sec. I and II

PREPARED BY:

CPT W. J. Brendel
TFPL

DATE: December 1967

REVISED BY:

CW2 G.R. Lazo
Airmenship Div.

DATE: June 1969

APPROVED BY:

DONALD J. LEWIS
LTC, Sig C
Chief, OCD

DATE: June 1969

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Navigational Computer (Slide Rule)

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PREFACE

This programed text is not in regular book form so you must follow directions in order to use it correctly. Each page is divided into three separate sections called frames. Page numbers are at the bottom center of the page and each frame is numbered in the upper right corner of the frame. You will begin by reading frame 1 at the top of page 1 and then continue to frame 2 at the top of page 3. DO NOT TRY TO READ DOWN THE PAGE. In most of the frames you will be required to answer a question or solve a problem. After writing your answer look on the back of the frame to check the correct answer. A small tolerance in the answers will be acceptable due to the difference in computers.

Allowable tolerances: Speeds± 1 knot
Distance± 1 mile
Time± 1 minute
Altitude± 200 feet

If you were incorrect, turn back and restudy the information before continuing on to the next frame. When you have finished a section of this text, complete the appropriate self evaluation exercise. Now begin by studying the performance objectives on page iv.

PERFORMANCE OBJECTIVES

Upon completion of this program you will be able to use the navigational computer to solve air navigation problems and find:

A. Ground speed
B. Enroute time
C. Distance in nautical or statute miles
D. Fuel requirements and consumption
E. True airspeed
F. Density altitude

SECTION I Frame 1

Remove the sliding card from the computer and lay it aside for now, you will cover it later. Now look at your computer, the computer side has the movable disc and two circular scales. The other side has a transparent disc located within a compass rose. This side is called the Wind face side or Grid side. First you should study the Computer Side.

Go to page 3 frame 2.

MILEAGE CONVERSIONS Frame 6

Often you will need to convert between statute miles, nautical miles, and kilometers. To do this you will use the "Stat", "Naut" and "Km" index. The "10" may be used to represent 1 mile, 100 miles or 1,000 miles. For this problem, "10" will have a value of 100 nautical miles. To convert 100 nautical miles to statute miles or kilometers, place the "10" under "Naut", now you read 115 under "Stat". What do you read under "Km"?

a. 18.5
b. 185
c. 1,850

Frame 11

132 nautical miles equals:

Select an answer:

a. 151 statute see page 5 frame 13
b. 152 statute see page 3 frame 12

Answer: b. 185

Frame 2

A diagram of the computer is shown on page 57. Tear out this page for future reference as you progress through this booklet. See figure 1 page 57. Study this picture a few minutes. The nautical, statute and kilometer indexes are located on the outer (inner-outer) scale. The speed and "sec" indexes are on the inner scale.

Frame 7

Since you found that 100 nautical miles is equal to 115 statute miles and 185 kilometers, now determine that 100 statute miles is equal to 87 nautical and 160,5 km.

Frame 12

132 nautical miles equals:

Select an answer:

a. 244 km see page 7 frame 14

b. 242 km see page 5 frame 13

Answers: outer

inner

Answers: 87

160

Frame 3

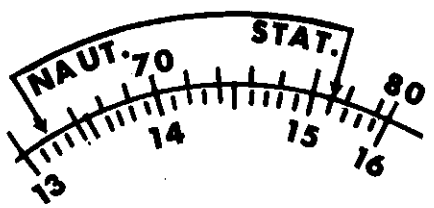
The large black triangle (▲) reference point on the movable scale is called the speed index.

Frame 8

Now convert 100 km to statute and nautical miles. By placing the "10" under the km index you read 62 statute and 53 nautical miles.

Frame 13

You're obviously trying to work too fast or you're having trouble reading the various scales on the computer. Let's look at the previous problem:



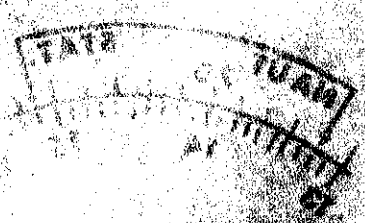
For the statute mile answer it had to be between 150 and 160. But, look again, how can the first line of the scale be 151? The same with the kilometers. Between 240 and 250 there are only five lines and they must be calibrated by two's. Now do this one:

132 nautical miles equals 151 km. Go to page 7 frame 14.

Answer: speed

Answers: 62.5 statute

54 nautical



Frame 4

Move the inner disc so that the "10" aligns with the "10" on the outer scale. Do all of the numbers align on the two scales?

yes
(yes no)

Frame 9

If you set 90 under the "Naut" index you read 104 statute mi. under the "Stat" and 167.5 km under the km.

Frame 14

Answer: 244 km - correct

Now convert 145 nautical miles to statute miles and kms.

167 statute

269 km

Answer: yes

Answers: 104
166

Answers: 167 stat

268 km

Frame 5

Since the scales are the same you can set up ratios and proportions using these scales.

Turn to page 1 frame 6

Frame 10

Using the computer you find that 280 nautical miles is equivalent to 325 statute miles or 528 kilometers.

Frame 15

Convert these:

a. 261 nautical	b. 65 nautical	c. 75 nautical
29 statute	74.7 statute	86.2 statute
46.6 km	120 km	139 km

Answers: 324

518

Go to page 1 frame 11

Answers: a. 25.2 naut b. 65 naut c. 86.5 stat

46.5 km 75 stat 139 km

Proceed with self evaluation exercise #1 on the next page.

SELF EVALUATION
EXERCISE 1

Using your computer convert the following:

1. 290 nautical miles

   334 statute miles

   536 kilometers

2. 244 nautical miles

   282 statute miles

   452 kilometers

3. 350 nautical miles

   404 statute miles

   649 kilometers

4. 48.6 nautical miles

   56.0 statute miles

   90 kilometers

5. 172 nautical miles

   198 statute miles

   319 kilometers

6. 165 nautical miles

   190 statute miles

   305.6 kilometers

7. 158 nautical miles

   182 statute miles

   292 kilometers

8. 81 nautical miles

   93 statute miles

   149 kilometers

Answers:

1. 334 statute
   536 km

2. 281 statute
   451 km

3. 351 nautical
   648 km

4. 48.7 nautical
   56.1 statute

5. 198 statute
   318 km

6. 165 nautical
   305 km

7. 158 nautical
   292 km

8. 93.5 statute
   150 km

Continue with frame 16 at the top of page 13.

SECTION II Frame 16

Next you must learn to work time-rate distance problems. The computer is designed with miles on the outer (inner/outer) scale and time on the inner (inner/outer) scale.

NOTE: For the remainder of this program we will use Nautical Miles (nm) and speed will be in Knots (k).

Frame 24

Practice with these problems:

A. Given: Distance = 170 nm.
Time = 1 hour and 10 min. 70
Find Speed 146 k.

B. Given: Distance = 340 nm.
Time = 3 hours 180
Find Speed 113 k.

C. Given: Distance = 16 nm.
Time = 4 min.
Find Speed 240 k.

Frame 32

Deciding which index, speed or sec, to use is confusing to some people. When you become an aviator you will always know when you want your time in seconds so throughout this text only use the sec index when the question asks for seconds.

Compute these:

	TIME	GS	DISTANCE
a.	95 min = 1h 35 min.	65k	104 nm
b.	90 seconds	80k	2 nm

Answers: outer

inner

Answers: A. 146

B. 113

C. 240

Answers: a. 1 hr + 36 min

b. 90 seconds

Frame 17

Suppose your speed is 70k and you maintain this speed for 18 minutes. What distance would you travel? First set the speed index () under the 70 on the outer scale. The speed index is 60 minutes. The set up you now have means you are traveling 70 nautical miles in 60 minutes. Therefore, to determine the distance covered in 18 minutes read the value on the outer scale over 18 minutes on the inner scale. Your answer, 21 NM.

Frame 25

From the previous problems you have learned to solve for speed (rate) and distance . During preflight planning the aviator knows the distance to be flown and the ground speed he expects to have. He must find the estimated time enroute (ETE) to enter on the flight plan. To solve for time set the speed index under the speed and on the inner scale read the time under the distance on the outer scale.

Frame 33

How much time is required to travel 2nm at a speed of 90k? (Use the sec. index). Select one:

a. 13.3 sec. See page 19 frame 35.

b. 80 sec. See page 17 frame 34.

c. 5 min. See page 21 frame 36.

Answer: 21

Answer: distance

Frame 18

Let's review:

In the previous frame you placed the speed index (▲) under the speed and read the distance over the time.

Frame 26

How much time is required to travel 180nm at a speed of 120k? First set the speed index under 120 and read the time under the distance (180). In this case it would require 1 hour and 30 minutes.

Frame 34

Answer: 80 sec.

You are correct.

Continue on page 23 frame 37

Answer: time

Answer: 1 hr and 30 min.

Frame 19

Solve this one. Speed = 130k; Time = 1 hr + 20 min; Find distance: Set the speed index under 130, then over 1 hour + 20 min (80), read the distance which is 174 nm.

Frame 27

During preflight you find that you must travel 375 nm at a speed of 78k, this would require (pick one below):

290

a. 2 hours and 05 min. See page 21 frame 28.

b. 4 hours and 48 min. See page 25 frame 30.

c. 29 min. See page 23 frame 29.

Frame 35

Your answer: A. 13.3 sec

You did not follow instructions. You placed the speed index under 90. Go to page 25 frame 30 and read again. Then go to page 15 and select another answer.

Answer: 173 nm

Frame 20

Today you are going to drive at a speed of 48k for 2 hours and 15 minutes. By so doing you will travel 109 nm.

Frame 28

Your answer: 2 hr + 05 min.

You must have used the wrong set-up. Remember the speed index must be placed under the speed. Return to page 15 frame 25 and review, then continue.

Frame 36

Your answer: C. 5 min.

Did you read from the inner scale out? That's wrong, go back to page 15 frame 33 and try another time.

Answer: 108

Frame 21

O.K., Now try another one:

Speed = 160k

Time = 1 hour + 20 minutes. 80

Distance = 214 nm.

Frame 29

Your answer: C. 29 min.

You must have misread the time. 29 in this case represents 290 minutes. Actually the correct answer is less than 290. Return to page 19 frame 27 and read the hour scale.

Frame 37

Try this one - THINK

At 72k how many seconds will it take to fly 2 nautical miles?

a. 10 seconds

b. 1 minute and 40 sec

c. 10 minutes

Answer: 213

Answer: 1 min and 40 sec.

Frame 22

Remember the relationship between distance, time and the index (distance on the outer scale, time on the inner scale and the speed index (▲) always pointing at the speed.) Suppose the pilot does not know his ground speed in flight but he finds that he flew a 40 nm leg in 18 minutes. To calculate his speed set your computer so that 40 miles (outer scale) is over 18 minutes (inner scale). Now read the answer over the speed index. Answer: 133 k

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Frame 30

Answer: B. 4 hrs + 48 min. Good, continue below.

Some problems will require the time to be computed in seconds and/or minutes instead of hours and minutes. For example, how much time is required to fly 2 nm with a speed of 150k? In this case it is easier to use the second index on the inner scale located at number 36.

Frame 38

Let's assume that after checking a map we find that the LZ (landing zone) is 1.5 miles from the RP (release point). In this problem we want to know the time from RP to LZ to the second. The speed is 80k. How long will it take?

a. 112 sec.

(b.) 67 sec.

c. 6.7 min.

Answer: 133

Answer: sec

Answer: b. 67 sec.

Frame 23

Once more, you fly 275 nm in 2 hours and 30 minutes. Set 275 nm (outer scale) over 2 hours and ~~30~~ 120/150 minutes (inner scale) -- notice 2 hours and 30 minutes is the same as 150 minutes, therefore you may use either time scale. Now read the speed of 105 k over the speed index (▲).

Frame 31

First set the sec. index under the 150 on the outer scale. The sec index represents 3600 seconds, or one hour. Therefore the ratio is still correct. Now under 2 miles read the time which is 48 seconds.

This method is only needed when you want the precise time required to travel a relatively short distance.

For instance: How many seconds will it take to fly 1.5 miles at 60k?

~~54~~ 90 seconds.

Frame 39

Now solve for time. READ AND ANALYZE the question because you'll need both indexes.

1. Distance = 1.5 nm
   Speed = 70k
   Time = 77 seconds

2. Distance = 80 nm
   Speed = 65k
   Time = 74 min = 1 hr. 14 min.

3. Distance = 100 nm
   Speed = 75k
   Time = 80 min = 1 hr 20 min.

Answer: 110

Go to page 13 frame 24

Answer: 90

Go to page 13 frame 32

Answers: 1. 77

2. 1 hr + 14 min

3. 1 hr + 20 min

Now do self evaluation exercise #2 on the next page.