

# Navigation Programs

## Introduction

This is an integrated set of five nautical navigation programs for use with an HP-41CX or HP-41CV with an Extended Functions/Memory Module. The programs are compatible with the HP Navigation Pac. They are integrated in that their register usage does not overwrite data previously entered and needed by the other programs or by programs in the HP Navigation Pac. Thus they may run at any time without reentering static data. The programs include:

### D=S\*T      Nautical Distance, Speed, Time

This program computes any of the values of distance, speed, or time given the other two values. The odometer value on the log and the starting time are entered at a known fix. Later values of time, distance, and speed are entered when known. The unknown value can then be calculated. Distance can be displayed in either log miles or miles from the fix. Besides using the primary fix as the point of reference, a temporary fix such as a waypoint may be entered without losing the primary fix.

### TIDE      Height of Tide

This program predicts the height of the tide using tide table data for the times immediately before and after the current time. It also shows whether the tide is rising or falling and the fraction of the way the tide is between low and high. Using the difference in chart datums for objects above water and for soundings, a correction to the charted height of objects is displayed. TIDE uses a subroutine contained in D=S\*T.

### RANGE      Distance of an Object by Sextant Altitude

This program calculates the distance to an object of known height whose apparent altitude can be measured with a sextant. The chart height should be corrected to height above sea-level using the TIDE program. The observer's height must also be known. The curvature of the earth and atmospheric refraction are taken account of in the calculation.

### CURR      Boat Heading and Speed in a Cross Current

This program computes the required boat heading and resulting ground speed of a boat sailing in a current. The current's direction and speed, and the boat's course and speed are used for this calculation.

### VEC      Vector Addition, Subtraction, and Interchange

This is a small general-purpose vector addition program. It computes the sum or difference of two vectors, or allows you to interchange the two vectors before taking their difference. VEC requires the Extended Functions/Memory Module.

## Loading the Programs

Each of the five programs has a key assigned to it for ease of use. The key assignment will be loaded automatically if the HP-41 is in USER mode when the program cards are read in.

1. Make sure the HP-41C is not in PRGM mode.
2. Set the SIZE to 66 registers.
3. Press GTO .. then check that you have at least 146 registers available.
4. Feed the program cards into the card reader. Press GTO .. after each program is loaded. Load the RANGE program last because it is assigned to the GTO key. After reading in the cards for RANGE, take the HP-41 out of USER mode before pressing GTO .. .
5. Turn on USER mode before using the programs.

If the programs are loaded while USER mode is on, they will be assigned to the following keys:  $D=S*T \Rightarrow LBL$ , RANGE  $\Rightarrow GTO$ , TIDE  $\Rightarrow FS?$ , CURR  $\Rightarrow P\rightarrow R$ , VEC  $\Rightarrow R\rightarrow P$ . Also, you might want to assign the Rumb Line program, RL, in the Navigation Pac to the ISG key. These key assignments are shown in the Keyboard Card Labeling page.

## Instructions for Running the Programs

$D=S*T$       Nautical Distance, Speed, Time

This is the major program in the set. Because of its capability to solve for distance, speed, and time interchangeably and relative to two fixes, it is the most complicated.

Start the program by entering ~~XEQ~~ "D=S\*T" or using the reassigned **LBL** key. The display will show the time and log value entered at the last fix point. Of course, if a fix has not yet been entered, the displayed values are meaningless.

Initialize the program using the actual time and ship's log values at a fix. Enter the time in the form hh.mm; then press Time **C**. The display will show the elapsed time from the previous fix. Enter the nautical miles from the ship's log; then press Odom. **B**. The display will show the distance from the previous fix. Press Fix Pt. **A** to establish a new fix. The calculated speed from the previous fix will be momentarily displayed. Then the log and time of the new fix will be displayed.

Now you can enter any two of the values for distance, time, or speed, and calculate the remaining one. Distance may be entered either as an odometer value on the ship's log or as the distance from the fix.

A known or assumed distance, time, or speed is entered into the computer by keying in the value and pressing the appropriate key (Odom., Time, Knots, or Dist.). Pressing any of these keys without entering a value, causes the value to be calculated and displayed with an asterisk. Any values that you enter will be stored in the appropriate registers. Calculated speed is also stored. Calculated values of distance and time are only displayed and will not be used in subsequent calculations.

For example, after you entered the fix, you can enter a later time and distance then calculate your speed. Enter a later time and press Time **C**. The display will show the elapsed time from the fix. Enter the corresponding log value and press Odom. **B**. The display will show the distance travelled from the fix. Calculate your speed by pressing Knots **D**. The display will show the calculated speed in knots. The asterisk in front of the value indicates that this is a calculated value. Now enter the distance from the fix to the next way point and press Dist. **E**. The corresponding log value will be displayed. You can calculate the time you should reach the next waypoint by pressing Time **C**. The assumed speed will display momentarily, then the log value and calculated time will be displayed. Similarly, you can compute a dead reckoning position at a specified time. Enter the time and press Time **C**. The display will show the elapsed time from the fix. To calculate the distance travelled, press Dist. **E**. The assumed speed will display momentarily, then the calculated dead reckoning distance and the specified time will be displayed. The **B** and **E** keys are complimentary ways of entering and calculating distance. Odom. **B** is used for odometer reading as shown on the log; Dist. **E** is used for distance from the fix.

This program can display distance, time, and speed from two fixes. For instance, the first point could be a real fix such as passing a known mark, and the second point could be dead reckoned turning point. The Base Exchange key, Base  $\neq$  Shift **A** toggles the program between standard and second fix displays. When set to second fix, the number 2 annunciator is shown on the display. The second fix must be initialized as the standard fix was. Enter the time and distance as before. Then press Fix Pt. **A** to establish the fix. Each fix mode maintains its own fix time, odometer and speed. However, the current odometer value and time, entered in either mode, remain the same after switching to the other mode.

An example will clarify this.

Assume the boat leaves point **A** at 12:00 with the odometer showing 1000. Initialize the program using this fix.

Enter 12.00 and press Time **C**; enter 1000 and press Odom. **B**. Then press Fix Pt. **A**.

The boat passes point **B** and changes course at 12:58 with the odometer showing 1005.9. Enter this way point. Then calculate the average speed and distance travelled.

Enter 12.58 and press **C**; enter 1005.9 and press **B**. Press **B** to calculate the average speed, 6.1 knots. Press **E** to calculate the distance traveled, 5.9 miles.

Now set a second fix by 1) pressing Base Exchange Shift **A**, and 2) pressing **A** to use the last time and odometer values for the second fix. At the current time, 14:00, the ship's log reads 1013.7. Enter these using the **C** and **B** keys as before. Then press **D** to calculate the speed, 7.5 knots, on the new course.

R01 = Current Odometer

R02 = Current Time (Hr)

R54 = Speed

R55 = Current Base Odometer

R56 = Current Base Time (Hr)

R57 = Alternate Base Speed

R58 = Alternate Base Odometer

R59 = Alternate Base Time (Hr)

Statement 55 XEQ 08

Statement 56 HR - deleted

USER

Base  $\neq$

Fix Pt. Odom. Time Knots Dist.

**D=S\*T RANGE**

**RL RTN**

**SF CF TIDE**

**HR CURR VEC**

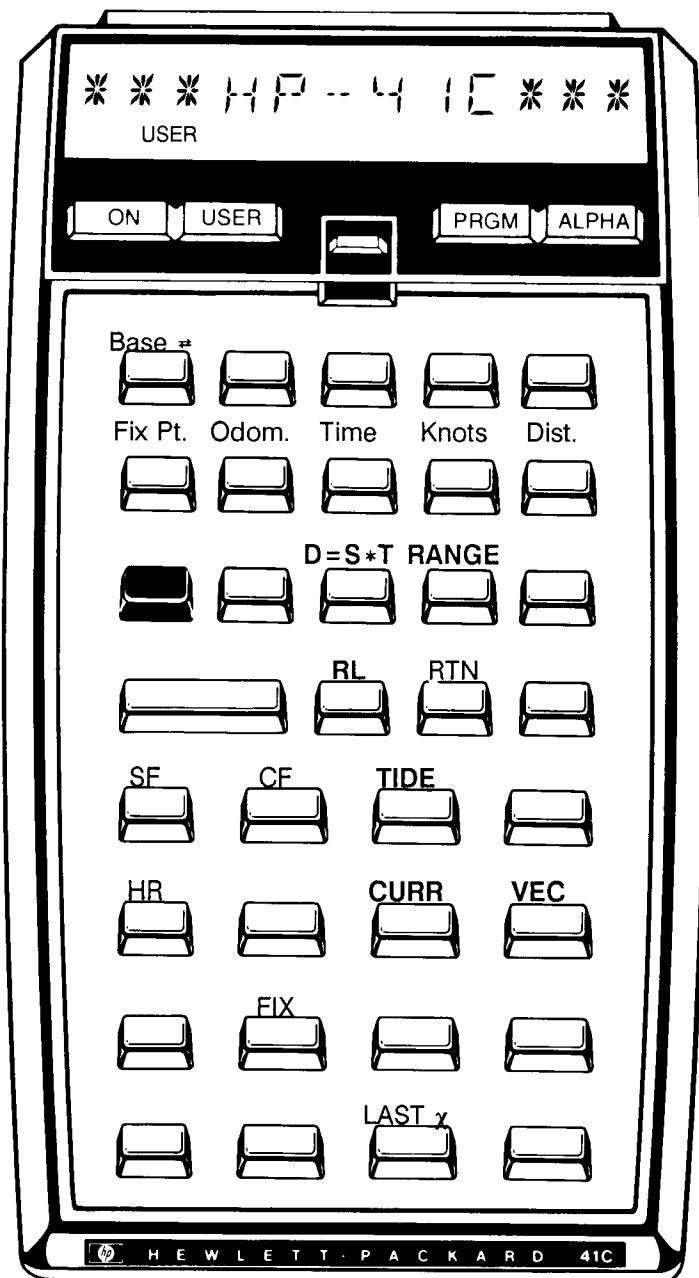
**FIX**

**LAST  $\chi$**

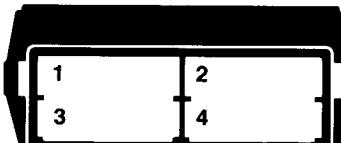
# KEYBOARD CARD LABELING

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## KEYBOARD



## SYSTEM CONFIGURATION



## CARD

