MODEL AV1 FLIGHT COMPUTER
OPERATOR'S GUIDE

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INTRODUCTION

Your ADM Systems Model AV1 flight data management system represents several breakthroughs in portable electronic flight computer technology. As you read through this manual and become acquainted with the features of the AV1 you will begin to appreciate the utility, power and simplicity of the AV1. Much of the simplicity and power are derived from the ability of the System to process alphabetic as well as numeric data so that displayed prompts for input data and results of computations can be clearly and unambiguously labeled. Each computational function is initiated by pressing a distinctly labeled function key. From there on you are led step by step through the procedure. You need not remember how to perform any computation. All the details are programmed into the AV1. All you need to know is what each function does. This manual will explain that in some detail.

The AV1 has all the usual flight computer functions plus great circle navigation capability to high accuracy and an extremely useful flight data log capability which you will find a great benefit in both flight planning and execution.

Perhaps the most unique feature of the AV1 is that its program memory is not all permanently determined at manufacture. While most of the functions reside in a permanently programmed memory, the weight and balance software resides in changeable program memory. This makes it possible to customize that function for your particular airplane. This programmable memory can also be used by you to implement other functions.

We are sure that you are anxious to start exploring the capabilities of your AV1 but would encourage you to be patient for a while. You have purchased a very versatile and powerful machine which will not only solve your flying problems but many others as well. In order to take full advantage of the System, you should know as much about it as possible. We will therefore ask that you read a bit before you start computing. Please follow in this manual through the section Using System Functions before branching off on your own. We promise some early hands-on practice with the computer.

The companion Applications Guide profusely illustrates the use of the AV1 functions and gives some background theory about several of the functions. This manual is more concise and is intended to provide only basic operating data. You should eventually be familiar with both manuals.

We are confident that after you have gained some familiarity with the AV1 you will find its alphabetic display capabilities make it so simple to use that you will wish to rely upon it in all phases of flight planning and execution. In so doing you will realize enhanced planning accuracy, fuel savings, and most important, better flight safety through a better informed pilot.

To assist you in using this manual, the following 14 pages constitute a tabular summary of the AV1 functions, displays, etc. They are collected at the front of the manual so that you can find them quickly. The explanatory text begins on page 17, and we suggest you turn there now.

TABLE I

AV1 COMPUTER FUNCTION DIRECTORY

TO:	Use Function	Page
Change a Single Flight Plan Item	*CHANGE	58
Compute Actual Time Enroute (ATE)	TIME/D:ATE	43
Compute Communications Range	CONV	38
Compute Course (Great Circle)	NAV:DST NAV:PLT	39 40
Compute Density Altitude	TAS:DA	50
Compute Difference of Two Times	TIME/D:ETA	44
Compute Distance (Great Circle)	NAV:DST	39
Compute Estimated Time of Arrival (ETA)	TIME/D:ETA	44
Compute Ground Speed (Distance/Time)	TIME/D:GS	42
Compute Ground Speed (Wind)	WIND:GS	46
Compute Heading (Wind)	WIND:GS	46
Compute Latitude, Longitude of a Point on a Great Circle	NAV:PLT	40
Compute Mach Number	TAS:TAS	49
Compute Standard Temperature	TAS:TAS	49
Compute True Air Temperature (TAT)	TAS:TAS	49
Compute Sum of Two Times	TIME/D:ΣT	45
Compute True Air Speed (TAS)	TAS:TAS	49
Compute Weight and Balance	*WT/BAL	62
Compute Wind Speed and Direction	WIND:WND	47
Convert Units	CONV	38
Delete a Line From Flight Plan	*DEL	71
Display Time and Distance To Go	*DTG	55
Display Course to a Waypoint	*CRS	52

TABLE I - FUNCTION DIRECTORY (Continued)

TABLE I - FUNCTION DIRECTORY (Continued)

NOTES:

1. Conversion Codes for use with CONV:

   FC °F to °C
   FM Feet to Meters
   MF Meters to Feet
   NS Nautical to Statute Miles; kt to mph
   SN Statute to Nautical Miles; mph to kt
   FR Feet Altitude to nm VHF Radio Range

2. *Denotes functions with gold labels. Press gold key first, then press key beneath label.

3. RE subfunctions (e.g. TAS:DA): Press key above white label corresponding to first part of name (E.G. "TAS"). Then press key in top row (A, B, C, D, E in blue) beneath display label of second part of function name (e.g. "DA").

4. See text for full explanation of functions and individual Function Descriptions under page numbers given. See Applications Guide for examples of use and sample problems.

TABLE II

FUNCTION SUMMARY

"COMPUTER" FUNCTIONS (WHITE LABELS)

SYMBOL	FUNCTION SUMMARY	PAGE
CONV	Unit conversions. Also finds VHF communications range.	38
NAV:DST	Finds the great circle distance and course (initial).	39
NAV:PLT	Gives data for plotting great circle courses.	40
NAV:PT	Gives coordinates of a point at specified distance along a specified great circle.	41
TAS:DA	Computes density altitude; computes standard temperature.	50
TAS:TAS	Computes mach number, true air temperature, and true airspeed from calibrated airspeed, altitude, and indicated temperature.	49
TIME/D:ATE	Computes Actual Time Enroute from times at two points.	43
TIME/D:ETA	Computes Estimated Time Enroute and Estimated Time of Arrival from ground speed, distance, and clock time at a fix.	44
TIME/D:GS	Computes ground speed from distance and time.	42
TIME/D:ΣT	Sums two times.	45
WIND:GS	Computes ground speed and heading from TAS, wind speed, and wind direction.	46
WIND:WND	Computes wind speed and direction from ground speed, TAS, course, and heading.	47

TABLE II - FUNCTIONS (Continued)

DATA MANAGEMENT FUNCTIONS (GOLD LABELS)

SYMBOL	FUNCTION SUMMARY	PAGE
ATA	Processes Actual Time of Arrival at the named waypoint. Updates entire flight log based on the new data.	54
ATD	Requests Actual Time of Departure.	69
CARD	Prepares the calculator to read flight log data from magnetic cards (card reader required).	57
CHANGE	Used to change a single entry in the flight log.	58
CRS	Displays the course to the current waypoint.	52
DEL	Deletes an entire line of the flight plan.	71
DIST	Displays the distance to the current waypoint.	52
DTG	Computes and displays time and distance to go to destination.	55
FIND	Moves the pointer to the log line specified by waypoint name or number.	60
FIX	Specifies the number of decimal places displayed when the calculator is used for ordinary (non-flight) mathematics.	72
GRD SP	Displays the (estimated or actual) ground speed to the current waypoint.	53
INIT	Used to input a new flight log. Erases all data in calculator memory.	67
INS	Inserts an entire line into the flight log.	70
NAME	Displays the name and number of the current waypoint.	51
N GS	Accepts new ground speed data and updates flight log.	66

TABLE II - FUNCTIONS (CONTINUED)

SYMBOL	FUNCTION SUMMARY	PAGE
N TAS	Auxiliary function for the entry of a new TAS.	72
N WIND	Accepts new winds data and updates flight log based on them.	64
P DN	Moves the pointer down one line of the flight log.	61
PRINT	Causes one line of the flight log to be printed (printer required).	59
P UP	Moves the pointer up one line of the flight log.	59
RECORD	Prepares calculator to record flight log on magnetic cards (card reader required).	56
RESET	Used to recover from errors, partial executions, etc. Prepares calculator for a new function.	73
SMMY	Causes the flight log to be printed (printer required).	73
TIME	Displays the time (actual or estimated) at the current waypoint.	51
WT/BAL	Computes weight and balance.	62

TABLE III

INPUT AND OUTPUT DISPLAY FORMAT EXAMPLES

INPUT DISPLAYS

DISPLAY	MEANING	ACTION REQUIRED
*CAS=?	A value for CAS is required.	Enter a value. Pressing R/S without entry will abort function.
TAT=?(C)	TAT is needed but will be computed if not entered.	Enter a value for TAT, or press R/S to have one computed.
IAT=?(S)	IAT is needed. If not entered, an appropriate value will be supplied.	Enter a value or press R/S to have a value supplied to complete the calculation.
TAS=133.5?	A value for TAS is needed. If one is not supplied, 133.5 will be used.	Enter a new value or press R/S to accept the value displayed.

OUTPUT DISPLAYS

DISPLAY	MEANING	ACTION REQUIRED
M=0.2056 R	The value of M is .2056 and more data is available. (R)	Press R/S to obtain additional data.
TAS=133.5KT	TAS is 133.5 kt. There is no more data from this computation.	None required. Recommend pressing R/S for KEY? display.
HDG=212.1	HDG is 212.1. No more information follows.	None required. Recommend pressing R/S.
T2=12:13:45E	Time 2 is 12:13:45 and is an Estimated time.	None required. Recommend R/S.
T2=12:13:45A	Time 2 was logged as 12:13:45, i.e., it is an Actual time.	None required. Recommend R/S.

Notes:

1. One example of each type of input and output display is given.
2. The fact that R appears adjacent to another symbol does not change its significance. For example, a display of 12:34:56ER means that the time is estimated and that R/S should be pressed.

TABLE IV

LIST OF ABBREVIATIONS USED

ABBREVIATION	MEANING
A	Appended to a time indicates an actual time
ATA	Actual Time of Arrival (at a fix or waypoint)
ATD	Actual Time of Departure (from the starting point)
ATE	Actual Time Enroute (between two fixes or waypoints)
AVG GS	Average Ground Speed (from the departure point to the current waypoint)
C	Degrees Centigrade
(C)	The parameter requested will be computed if not entered by the user.
DA	Density Altitude, feet
DEP NAMEO	Departure Name, i.e., name of the departure point which is waypoint number 0.
DIST	Distance
DIR	Direction of a Calculated Wind
DST	Distance
DSTi	Distance for Leg Number i (i=1,9)
D TO GO	Distance to Go (from the present waypoint to the final waypoint (the destination)
E	East (appended to a time display indicates an estimated time)
ETA	Estimated Time of Arrival (at a waypoint)
ETE	Estimated Time Enroute
GS	Ground Speed
HDG	Heading
IAT	Indicated Air Temperature (thermometer reading)
KT	Knots
LAT	Latitude

TABLE IV - LIST OF ABBREVIATIONS USED (Continued)

ABBREVIATION	MEANING
LAT DST	Latitude of the Destination airport or point
LAT SRC	Latitude of the Source (departure) airport or point
LON	Longitude
LON DST	Longitude of the Destination airport or point
LON SRC	Longitude of the Source (departure) airport or point
M	Mach number
MAG	Magnetic
N	North
NAME	Name of a waypoint (fix). Three letters long.
NAMEi	Name of waypoint (fix) number i.
NM	Nautical Miles
NO LEGS	The number of legs (segments) in a flight plan.
OAT	Outside Air Temperature. Thermometer reading when aircraft is at rest.
PR ALT	Pressure Altitude. Altimeter reading when set to 29.92 in Hg.
R	There is more data available from this function. May appear by itself or as the last character in the display. R/S key should be pressed to continue execution of the function.
RANGE	Approximate "line of sight" range for VHF communications.
S	South
(S)	A value for the requested parameter will be supplied by the calculator if not entered by the user.
SM	Statute Miles

TABLE IV - LIST OF ABBREVIATIONS USED (Continued)

STD T	Standard Temperature. The temperature found at a given altitude in the standard ICAO Atmosphere.
T	Degrees True (i.e., with reference to true or geographic north).
T1	The time at the first of two fixes or the first of two times to be summed by ΣT.
T2	The time at the second of two fixes or the second of two times to be summed by ΣT.
Ti	The time (actual or estimated) at waypoint number i (i=0,9). This meaning for i=1,2 applies to flight logging functions. The meanings of T1 and T2 as given above apply to functions TIME/D:GS, TIME/D:ATE, TIME/D:ETA, and TIME/D:ΣT.
TAS	True Air Speed
TAT	True Air Temperature (IAT corrected for compressibility)
TTG	Time to Go. Estimated or actual time from the current fix to the last (destination fix). Time to complete the flight.
W	West
WND DR	Wind Direction. Note whether Magnetic or True.
WND SPD	Wind Speed
WPT	Waypoint. Another name for "fix".
WS	Wind Speed
ΣDIST	The sum of the distances for all legs, i.e., the total flight length.
?	Indicates request for input data.
*	Indicates that input data must be supplied or function will terminate.

FLIGHT LOG

NO	NAME	TIME	COURSE	DISTANCE	GROUND SPEED
0	SJC	13:18:00A			
1	SCK	13:44:00A	035	44	101.5
2	LIN	13:51:00A	012	16	137.1
3	RNO	14:25:00A	029	109	192.4
4	LOL	14:44:34E	039	60	183.9
5	BAM	15:11:00A	050	81	183.9
6	EKO	15:31:00A	059	54	162.0
7	BVL	16:17:54E	074	91	116.4
8	SLC	16:59:15E	067	81	117.5
9	FBR	17:36:28E	049	76	122.5

POINTER →

TABLE V. Flight Data Log showing example information for a flight of nine (the maximum) legs. "Pointer" indicating line 2. See text.

TABLE VI

SYSTEM MESSAGES

MESSAGE	INTERPRETATION/ACTION
ALTER KEY?	You have selected the CHANGE function. You should press the key for the parameter (Name, Time, Course, Distance, or Ground Speed) that you wish to change before pressing any other key (including RESET which will nullify the change status of the system).
BAD NAME	In response to a request for a waypoint (fix) name you have entered a name which is not on the flight log, i.e., it is not in memory. Execute RESET and then the original function again. This time use a valid waypoint name, or if it is not known, number.
CARD	Card reader ready. Insert data cards or press left arrow key and RESET to clear.
CARD ERR	See CHECKSUM ERROR.
CHECKSUM ERROR	See MALFUNCTION. If repeated on subsequent tries, the card is bad. Press left arrow key and RESET to clear.
CONVERSION?	The system has been requested to perform a conversion. You should enter the conversion code and press R/S.
DATA ERROR	An attempt has been made to process faulty data resulting in an error in calculation. Execute RESET.
KEY?	Standard prompt. This prompt will be displayed whenever the system is ready for a new function to be executed. If this prompt appears during your attempt to execute a function before you get an answer, it is because you have neglected to provide requested data or some other error. The system cannot do your calculation, gives up, and asks for another job.
MALFUNCTION	There was an error in reading or recording a card. Reinsert the card. See the Card Reader Owner's Handbook. Press left arrow key and RESET to clear.

TABLE VI - SYSTEM MESSAGES (Continued)

MEMORY LOST	Power to the continuous memory has been interrupted or the memory has been cleared either intentionally or due to a fault. See In Case of Difficulty and reload the weight and balance software (see Weight and Balance).
NONEXISTENT	Card reader or printer is not connected. You have attempted a nonexistent conversion or there is an error of another type. Execute RESET. Press XEQ, ALPHA, S,I,Z,E, ALPHA 0,6,3
NO ROOM	You have attempted to insert a line in the flight log after the ninth entry. There is no more room. Press R/S or RESET to clear. If you wish to enter the new waypoint another will have to be deleted. If you wish to delete the last (WPT9), INSERT from WPT 8.
NULL	You have held the function key down for more than about one second causing the function to be nullified. If you wish to execute this function, press the same key again but release it more quickly.
OUT OF PAPER	The printer is out of paper. Load a new roll.
PRINTER OFF	The printer is connected to the HP41C/V but is turned off. Turn it on and press R/S.
PROTECTED	Shows briefly followed by RDY CRD 01 of 04. You have attempted to record a flight plan onto a protected card (corner clipped). Select an unprotected card or override the protection as follows. Press the left arrow key to terminate the record operation. Take the computer out of USER mode by pressing the "USER" button. USER annunciator will extinguish. Press PRINT key (gold key first). Display shows SF__. Enter 1,4. No R/S is necessary. Press USER button again and proceed with RECORD function. See the Card Reader Owner's Handbook.
RESET? Y/N	You have indicated that you wish to change a waypoint time. This cannot be arbitrarily changed but must be reset to zero. If you wish to reset, enter Y and press R/S. If not, enter N and press R/S. Reset values are updated at the next ATA, N GS, or N WIND execution.

TABLE VI - SYSTEM MESSAGES (Continued)

ROM	You probably have the computer in Program Mode. Check for "PRGM" annunciator. If it is showing, press PRGM button and then RESET.
RDY mm OF nn	Card reader ready for additional cards. Insert one at a time. mm, nn=01-04.
ZERO GS? Y/N	You have indicated that you wish to change calculated ground speed. See "RESET?" and respond in the same way.

WHAT IS THE AV1?

SYSTEM DESCRIPTION

The Model AV1 computer is similar to all other electronic flight computers on the market but differs radically in some very important aspects. Like the competition, ADM Systems has selected a basic calculator and "modified" it to do aviation problems. All such calculators consist of an arithmetic processor, control logic, and memory. The arithmetic processor does addition, subtraction, multiplication, and division in response to instructions provided to it from memory via the control logic. All problems essentially resolve themselves into a series of these four functions. To solve a problem such as, for example, a ground speed problem, one divides the distance covered by the time it took to cover that distance. The flight computer needs to have the two parameters, distance and time, placed in its memory. The arithmetic processor must then be instructed to convert the hours, minutes, and seconds into decimal hours and must then divide this time into the distance. The instructions to do the conversion and the division are stored in another portion of the computer's memory (distinct from the portion that stores the data.) This memory is usually a permanent, unalterable form of memory called Read Only Memory (abbreviated ROM). The manufacturer of the computer codes the proper instructions into the ROM and wires the ROM into one of his regular product line calculators thus making it an aviation calculator (or a finance calculator, etc.). ADM Systems has done essentially the same thing but with the following important differences:

1. The fixed program memory is not permanently wired in. It can be removed restoring the calculator to its basic unmodified form. Removing the memory does not erase it.

2. We have chosen a fully programmable, 130 function calculator which is the heart of a system supporting several peripheral devices.

3. The programmable memory in the computer is customized for the individual user's weight and balance problems.

4. The programmable memory is available for user written programs. This memory can be expanded.

The flexibility implied by these features does not result in a complex machine. When the ROM is installed, the calculator is as simple to use as any other, or simpler because of the alphabetically labeled display.

SYSTEM COMPONENTS

The basic system consists of an HP41C fully programmable scientific calculator, one plug-in memory expansion module (HP82106A) used to store your data*, one ADM Systems plug-in ROM (82500A-A09) which contains the instructions for the majority of the computation routines, one plastic overlay for the keyboard which relabels the keys for the aviation functions, and one set of custom weight and balance software, which resides in the programmable memory of the calculator. The weight and balance software is described in the next paragraph in some more detail.

WEIGHT AND BALANCE SOFTWARE

Because the loading for each airplane is different, it is impossible to program weight and balance software for all users into the permanent memory of the system. Some manufacturers attempt to do this by writing software which demands that the user enter empty weight, empty moment, maximum gross weight, and the arms for all the loads each time the computation is done. It is questionable whether such programs represent savings in labor over manually computing loading by graphical or table methods. One of the most valuable features of the AV1 System is that it contains programmable memory as well as the unchangeable memory in the ROM. This memory can be programmed with the weights and arms for your airplane and if you bought your AV1 from ADM Systems directly, this was done for you prior to shipment. Should you ever change the weight and balance of the airplane you fly or even change to a new airplane, you can modify the program to contain the correct data. The chapter Weight and Balance tells how to do this. If you bought your AV1 from a dealer or another source, the included weight and balance software will have to be changed by you. This is not difficult.

The flexibility of the programmable memory is offset by the disadvantage that it is not as permanent as the ROM. If it can be changed intentionally, it can also be changed unintentionally or lost. Loss will occur if power is interrupted to the continuous memory of the System or if the memory is reset accidentally or purposefully. Power loss will occur only if the batteries are removed from the calculator for periods in excess of a minute, or if the batteries are allowed to go dead in the calculator. This is unlikely to occur since batteries last several months. Reset can occur accidentally if you plug in or unplug modules or accessories with the calculator or the accessory turned on. Should the weight and balance software be lost for any reason, it can be reloaded via the procedures outlined in the chapter Weight and Balance.

Should the display show "MEMORY LOST" when you turn the System on, you should refer to In Case of Difficulty and reload the weight and balance software. The "MEMORY LOST" display is

*The HP41CV is the same as the HP41C in every regard except that it contains five times the memory; therefore, the memory expansion module is not required with the HP41CV.

an indication that the weight and balance software has been lost. Note that the other programs, those in the ROM, cannot be lost unless the ROM is damaged as, for example, by unplugging it while the calculator is turned on.

Before using the weight and balance software for actual flight you should test it thoroughly by comparison with manual computations. If there is disagreement, see the weight and balance chapter.

PERIPHERALS

The AV1 computer supports two peripherals at the present time. Both of these plug into slots on the back of the calculator body (ports 3 and 4). These peripherals are, of course, also able to support other programming for the basic HP41C calculator. These peripheral devices are sold by Hewlett Packard dealers. See the Yellow Pages for the name of the nearest dealer.

The HP82143A portable thermal printer is used to give you a printed record of all computations. Special programming in the AV1 is provided to make the printer especially useful in conjunction with the flight logging functions. Examples of the printer output are given in the individual function descriptions later in this manual. The printer is powered by rechargeable nickle cadmium batteries and is, therefore, completely portable. To use the printer, plug it into port 3 (make sure both calculator and printer are turned off first), turn calculator and printer on, set the printer mode switch to NORM and proceed as you would normally.

The HP82104A Card Reader attaches to the top end of the HP41C. In so doing, it inserts a plug into port 4. The card reader makes it possible for you to record the complete flight log at any time. The medium is a small magnetic card about the same length as and about two thirds the width of a stick of chewing gum. This feature is particularly useful if you fly certain routes frequently. You can record the basic flight plan on a card and read that card each time you make the flight. There is no necessity to load the flight log into the machine manually each time you make the trip. You can also make up a VFR and an IFR plan, record each and choose the one you need at the time of flight. If you are planning a day's flying with several stops, each flight can be recorded separately and entered instantly when needed. Flights of more than nine legs are conveniently handled by dividing the checkpoints between two cards. Finally, the contents of the AV1 at the end of a flight can be recorded for historical or comparison purposes.

To use the card reader, turn the calculator off. Plug the reader into port 4. Follow the directions given for the functions RECORD and CARD given in the functions description portion of this manual.

The card reader may also be used to record your weight and balance software which is then simply read back in from the card

in event of loss. Instructions are in Section 2 of the Card Reader Owner's Handbook.

HP41C/V CALCULATOR CAPABILITIES

In this section you will change the AV1 computer back into an HP41C calculator and explore some of the calculator's basic properties. You may wish to skip this section for now.

At this time, if you haven't already done so, remove the calculator from the carton. Notice that there are four slots in the top end of the machine. Two are covered by dust covers and the others are labeled "Memory Module" and "Aviation AV1", respectively. Make sure the calculator is turned off. This is indicated by a blank display. Remove the plug-in labeled "Aviation AV1" by pulling gently on the tab on the module. Place one of the dust covers (loose in the carton) in the slot. Move the slide at the center of the top of the keyboard up thus releasing the plastic overlay which should fall away if you turn the calculator upside down. At this point you have a basic HP41C calculator in your hands with one plug-in memory expansion module.

Now set this manual aside and turn your attention to the HP Owner's Handbook and Programming Guide. Go through the introduction and first three sections of Part I. Section 3 is optional at this time, and it is not necessary that you be terribly thorough with the other material. We hope that eventually you will want to take the time to go through the whole manual in order to learn about all the power of your HP41C/V. It is a truely remarkable machine with unlimited applications in numerous fields. Return to this point when finished.

Before continuing, we will remove the program HEAT from the memory. You need not do this if you did not load the program in while working through the HP Handbook. Press the following keys in order (calculator on): XEQ, ALPHA, C, L, P (these letters are the blue letters on the key faces), ALPHA, ALPHA, H, E, A, T (blue letters), ALPHA. Pause for about one to two seconds between the two ALPHA keystrokes. The display will show "NONEXISTENT" if program HEAT was not in the memory.

Now turn the calculator off, remove the dust cover you installed in the number 2 port and replace the "AVIATION AV1" module. Replace the plastic keyboard overlay. You have now converted the HP41C into the AV1 flight computer. In the introduction section of the Hewlett Packard manual you saw how a program is loaded into the programmable memory and assigned to a key. The ADM Systems ROM contains 56 such programs, 28 of which are assigned to keys whenever the computer is turned on with the ROM plugged in. The weight and balance software is in the programmable memory (RAM).

BASIC OPERATION AND FEATURES OF THE AV1

INTRODUCTION

If you read the Hewlett Packard Owner's Handbook and Programming Guide chapters as suggested in the last section, you already have some familiarity with the computer and its features. In this chapter of this manual, we will expand on some of these features and emphasize the basic operations.

Turning the System On and Off

The AV1 is turned on and off by successive presses of the ON button (just below the display panel at its left hand end). Before doing this you should be sure that the AV1 ROM is plugged into the back of the calculator. Note that nothing must be plugged into or removed from any of the ports on the back of the calculator when it is turned on.

When you turn the computer on (with the ROM installed) you should see "WORKING" in the display and the small annunciators "USER" and "PRGM". An airplane shaped symbol should then appear briefly. This symbol and PRGM should disappear and the display should show only "KEY?" and the small annunciator "USER". If anything else appears in the display, proceed as in the following table:

DISPLAY SHOWS	DO THE FOLLOWING
"KEY?" and "USER"	Nothing. This is the normal turn-on display.
"PRGM"	Nothing, will extinguish momentarily.
"ALPHA"	If "PRGM" is also present, wait until it extinguishes. Press ALPHA button.
"USER" missing.	Press USER button. Make sure ADM Systems ROM is installed.
Small 0,1,2,3,4	Press RESET (gold key, then RESET key).
"GRAD" or "RAD"	Press in sequence the keys XEQ, ALPHA, D, E, G, ALPHA.
"BAT"	Continue but replace batteries as soon as conveniently feasible.
"SHIFT"	Press gold key.
"KEY?" missing, anything else present.	Press RESET (gold key, then RESET).

If you are unable to obtain the "KEY?" display after pressing the ON button and RESET, turn the calculator off and then on again. If you still cannot get "KEY?" after processing RESET, refer to the chapter In Case of Difficulty at the back of this manual.

The annunciator "USER" must be present for the AV1 functions to operate. Manual computations which involve any but the simplest functions of the HP41C/V are facilitated if the USER mode is turned off. This is done by pressing the USER button whereupon "USER" extinguishes.

The calculator is turned off by pressing the "ON" button a second time. If the calculator will not turn off when you press "ON", see In Case of Difficulty.

The Continuous Memory

The HP41C/V is furnished with continuous memory, that is memory which is retained after the system power is turned off. This memory holds both your custom weight and balance software and the data you enter into the system. This memory draws miniscule amounts of power from the batteries and therefore remains alive as long as batteries are in the system. You may even remove the batteries for up to about a minute to replace them without losing memory. If the tiny annunciator "BAT" appears in the left hand end of the display, it means that the batteries are low and should be replaced. If you are in mid-flight, there is no need to worry. Even after the annunciator appears, you have about a month's life left but will be unable to use the card reader. The motor is the largest system load. See Appendix B of the HP Owner's Handbook and Programming Guide for instructions on battery replacement.

The continuous memory makes it possible for you to do things like loading the system memory with a flight plan hours or days before the actual flight.

The Automatic Turn-Off Feature

If you leave the system turned on for about 10 minutes with no interaction, it will automatically turn itself off. No data or programming is lost in this case. At turn-on you may not get a "KEY?" display and should press RESET if this is the case (see below).

Description of Keys to be Pressed

In the remainder of this manual, we will be instructing you to press keys in sequence. The keys will be described by their labels. When directed to press a key, find the label on the key itself, on the plastic overlay, which is to be in place whenever the AV1 is used as an aviation calculator, or on the sloping front of the key. If you find the label on top of a

key simply press the key. Examples are the numbers 0-9, ENTER, the left arrow key (right-hand most in the fourth row from the top) and CHS. If the label in the instructions is a single letter, look for it in blue on the sloping front of the key and then simply press the key.

If the key label is found on the overlay in white (example: TAS), press the key above the label (rightmost key in the second row with TAN on its top in this example). If the key label is in gold on the overlay (for example, GRD SP) press the gold key (leftmost in the third row) first and then the key beneath the label (the same TAN key in this example). The gold key is a shift key. When you press it the display shows the annunciator "SHIFT" and the next key pressed will access the gold labeled function above it. If you wish to cancel the shift, press the gold key again (before any other key) and the "SHIFT" will disappear. If "SHIFT" does not appear in the display, the next key pressed will execute the function named in white below it on the overlay if there is one, or the function on the top of the key if there is no white function on the overlay.

If you accidentally press the keys XEQ, STO, or RCL, press the back arrow key to clear the display. If you accidentally press EEX, press the back arrow key twice to clear the display.

When any key is pressed and held, the display shows a code for the function. If the key is not released within about half a second, the display changes to "NULL" and the function request is cancelled.

The RESET Function

When the system is ready to perform a function for you, it lets you know this by the request "KEY?" which tells you that the system is completely ready and asks you to press the key for the function you desire. It is good operating practice to have "KEY?" displayed before activating any function, although it is not necessary to do this in most cases. If you turn the system on and "KEY?" is not displayed, the system is brought to the ready mode by simply pressing the RESET key. Note that this is a gold labeled function and is over the rightmost key in the bottom row. The gold key is pressed first and then the labeled key. If you permit each function you select to run entirely, that is, if you follow the entire sequence of prompts as given in the display (and as tabulated in the function summaries which follow) and then press R/S (which is the same key as the RESET key but the gold key is not pressed first) the system will return to the ready mode and display "KEY?". If you are in the middle of a function and stop it (see next subsection) and then press RESET or if a function is partially completed and either awaiting input or displaying output and you press RESET, the system will reset to the "KEY?" state. The exception to this is if the system is expecting an alphabetic input. In this case, the display will show the annunciator "ALPHA" which must be extinguished by pressing the ALPHA button before the RESET key.

Note that the system will usually place itself in the "KEY?" state automatically at turn-on. Normally, when you press the ON button, the calculator displays "WORKING" briefly, beeps and then displays "KEY?" showing that it is ready to go. If "KEY?" is not displayed, press RESET.

The R/S Key - Starting and Stopping

The R/S key (rightmost key in the bottom row) is the system control key. The letters mean Run/Stop. The key is used to start and stop execution of functions. Normally you will use it only to continue a function which you have selected and which has stopped to request input or display data. When you select a function by pressing the appropriate function key, the system begins to execute that function and will continue to do so until it needs an input or has some information to display. At such times the system stops executing and shows you the display. Some action is then required by you, such as the input of requested data. You take the required action (the display tells you what it is) and then press R/S which starts the system running again. It continues to run until it needs to display something again at which time the sequence is repeated.

If the display is requesting input information, it will contain a question mark (?). Enter the requested data and press R/S. If the display is showing output and the last character in the display is 'R' this means the calculation is not finished. There is more data. Press R/S. If the display shows output with the terminal 'R' not present, this is the end of the function. Press R/S to return to the "KEY?" display.

The R/S key can also be used to halt execution of a function in progress. If you start a function and know you are in error and wish to stop it, press R/S. Then press RESET and start over. You can tell if the system is executing a function. The display will show the annunciator "PRGM" meaning that a program is running. The display may also show a little airplane-like symbol which moves from the left to the right-hand side of the display as the program runs. Attempting to press RESET while these conditions are present will have no effect. Press R/S first. This causes both indications to disappear indicating that you may press RESET. The situation where you halt a program in mid-execution is the one situation where you very definitely should press RESET before any other keys.

Example Problem

At this point, we would like to take you step by step through a sample problem. This will make the following pages clearer. Follow all the steps exactly as given below. If you fail to achieve the results we describe, press RESET (assuming that execution is stopped) and start over again. If you have continued difficulty, turn the system off and then on again and try once more. If you still cannot get the desired result, refer to the chapter titled In Case of Difficulty.

The problem we have chosen as an example is a simple true airspeed (TAS) problem. Assume you are at 12,000 feet with an indicated airspeed of 124 kt. The thermometer reads -10°C. What are the mach number and true airspeed?

Make sure the ROM and overlay are installed. Turn the system on. The calculator should display "WORKING", beep, and display "KEY?". The annunciator "USER" should also be on. If "KEY?" does not appear, press RESET.

The name of the function to be run is TAS. TAS is an overlay function in white so press the key above it (rightmost key in the second row). The display will change to show "TAS:DA". These are subfunction labels and will be explained in detail in the next chapter. Press the key in the top row under the display label "TAS". This is the A key, i.e., the key with a blue A on its front. The display will show "*CAS=?". Execution is stopped to request the input of calibrated airspeed (CAS). We use the value 124.0 kt as a CAS. Enter this number by pressing the keys 1, 2, 4, decimal point key, 0. The display will show "124.0". Now restart the system by pressing R/S. The display will change to show "*PR ALT=?" indicating that pressure altitude must be entered. The asterisk (*) in these displays means that data input is required. If R/S is pressed without data entry, the function will abort and the system will return to the "KEY?" state. Press the keys 1, 2, 0, 0, 0 in that order to enter 12,000 feet and start execution again by pressing R/S. After a moment the display will show "M=0.2348 R". This means that the Mach number for 124 kt CAS at 12,000 feet pressure altitude is .2348. The R means that the function has more information for you and that you should start it running again by pressing R/S. Press R/S. The display will blank to reappear showing "TAT=?(C)" meaning that the system needs a value for true air temperature (TAT) to continue the computation. The "C" in parentheses in the display means that if you cannot provide a value of TAT, the system will compute one for you. Assuming that your airplane does not have a TAT gauge, this would be the case. Compare this with the last two requests for input. No asterisk appeared in the display when TAT was asked for so that we may press R/S without entering the requested data and still continue the problem. Press R/S now to continue.

The display will shortly show "IAT=(S)?" meaning that a value for indicated air temperature is required to compute TAT and thereby continue the computation of TAS. Note that the asterisk is again not present. This means that you need not enter IAT if you do not have it. The "S" means that if you do not enter IAT, a temperature value will be supplied by the system. This value will be the standard temperature at the pressure altitude (12,000 feet). Let us assume the OAT gauge works and reads -10°C. Enter this value by pressing the keys 1, 0, CHS. CHS changes the sign of the number in the display. Restart execution with the R/S key. After a moment the display shows "TAT=-12.9 R". This means that the true air temperature under the conditions

we have entered is -12.9°C and that the system has more information (R). Restart it with R/S and the display shows "TAS=147.4KT" which is the true airspeed for the parameters we have supplied. This completes the sample problem. There is no terminal "R" in the display to tell you that the system has more information. Press R/S once more and the system returns the display "KEY?" indicating that it is ready for the next task.

You may wish to repeat the sample problem for more familiarity. You may try different values, eliminate IAT input or try TAS with a TAT input. When you are finished, turn the calculator off.

Data Input and Output Convention

The AV1 has standard means for labelling its requests for input data and its displays for output data. You saw some of them in the sample problem. All functions except the unit conversion function use the same format. When the system requires an input data value for computation, the display always shows exactly what data is required by an abbreviation (see Table IV, page 10) followed by the symbol "=?'. The display may appear in several forms each of which has its own meaning. If the first symbol in the display is an "*", this means that the data requested must be provided by the user if the computation is to be completed. The system cannot complete your requested calculation without the input and will return to the "KEY?" display if R/S is pressed without input. An example was the display "*CAS=?" in the sample problem. If, conversely, the display does not show an "*", this means that data input is not required, i.e., that the system can continue your computation without the data asked for. Usually there is a symbol indicating how the system will proceed if the requested data is not furnished. (C) means that the requested data will be calculated if not furnished by the user. The user will be requested to enter values for other parameters to permit the computation of the omitted parameter. An example of this situation was the display "TAT=?(C)" in the sample problem. It means that the system needs True Air Temperature to compute TAS and that you should enter a value for TAS if you have one. The (C) means that if TAT is not entered, it will be computed. When you pressed R/S without input in the example, you were requested to enter the Indicated Air Temperature (IAT). TAT was computed from the IAT. The symbol (S) means that a value will be supplied if one is not entered. The difference between (C) and (S) is that additional input is not required in the case of (S). In the sample problem, if we had not provided an input value for IAT in response to the display prompt IAT=?(S), the system would have supplied the value of the standard temperature for the altitude.

The third type of data input prompt gives the abbreviation for the data type, followed by "=", followed by a numerical value and then the "?". An example would be "TAS=133.5?". Since there is no "*", input data is not required. If data is not entered

(i.e., if R/S is pressed to continue execution of the calculation) the data value displayed will be used. This means that if one wished to use the value 133.5 (in the example just given) he simply presses R/S. If, on the other hand, he wishes to enter a new value (different from 133.5) he may do so. When R/S is pressed, the new value is processed. This feature is a very valuable one. The number displayed in cases like the one we have just used as an example is the value that is the system memory from a previous input or computation. Using the TAS example for illustration again, we suppose that TAS has just been computed by the TAS function. It is a needed input for the wind functions. The pilot can carry the TAS value directly into the wind computation functions without the need to write it down or otherwise note it. When the wind function prompts for TAS, it will display the value of TAS computed by the TAS function. The Applications Guide has numerous examples of how this feature works.

Output data is always labeled with an alphanumeric abbreviation (Table IV), just as are input prompts. Output data is sometimes additionally labeled with units where appropriate. For example, TAS from the TAS function is presented as "TAS=133.5KT". In other cases no units are specified. If the last character in the display is an "R", this means that additional data is to be displayed and/or computed. When the "R" is seen, this means that you should press the R/S key to continue the computation and/or display of information. If no "R" is displayed with output data, it means that the execution of the particular function is complete. Pressing R/S will return the display to "KEY?". This is an advisable practice.

The System keeps track of time with reference to the 24-hour clock. All system times are thus displayed with hours between 0 and 23. Computed times are usually shown as hh:mm:ss, e.g., 23:45:58 means 23 hours, 45 minutes and 58 seconds. No special treatment is required for times near midnight (00:00:00). The system never displays times greater than 24 hours.

Time displays are often followed by an A or E in the display. An A signifies that the time is an actual time that you have previously logged. E signifies that the time is an estimated time and is based upon a computation.

When times are entered into the system, the decimal point is used to separate hours and minutes. The System interprets the first two digits after the decimal point as minutes and the second two as seconds. The time 12:34:56 is, therefore, keyed in as 12.3456. The ATD function (see the ATD function description) displays time in this format.

To use the unit conversion function, the number to be converted is first placed in the display and the CONV key pressed. When the display shows "CONVERSION?" a two letter conversion code is entered. The conversion takes place when R/S is pressed. See the CONV Function Description.

The data input and output conventions are summarized in Table III, page 9.

Entering Numeric Data

When requested to enter numeric data by the display, you simply press the appropriate numerical keys in sequence. To enter 123.4, for example, you press the keys 1, 2, 3, decimal point key, 4. The number just entered will appear in the display. It will be processed when you press R/S to start execution. To enter a negative number, enter the positive number first and then change its sign with the CHS key. For example, to enter -123.4 press 1, 2, 3, decimal point, 4, CHS. If you enter a digit or digits in error they may be corrected any time before you restart computation. Simply press the back arrow key (right-handmost in the fourth row). Each time it is pressed, the right-handmost character in the display is erased. If pressed a sufficient number of times the entire display will be erased and will show zero. You may reenter the correct digits as soon as the erroneous ones have been erased. The sign may be changed back and forth by successively pressing CHS.

Entering Alphabetic Data

The entry of alphabetic data is similar to that of numeric data except that the keys with the appropriate blue letters on the front are pressed in order. For example, to enter "AML" press the blue labeled keys A, M, L. The back arrow key works in the same way except that the display will be totally blank if it is pressed enough times. To enter numerals, press the shift key first. To enter "W32", press the blue key W, SHIFT 3, SHIFT 2. This is only done when the numbers are part of an alphabetic name input.

You will always know when alpha input is required. The display will show one of the prompts "NAME=?", "RESET? Y/N", "ZERO GS? Y/N", or "CONVERSION?". In the former case, enter the letters of the name. Restart execution with R/S. In the second and third cases, a "yes" or "no" answer to a question is sought. Answer with the single character "Y" or "N" and restart execution with R/S. In the last case, a two letter unit conversion code is expected. Enter it and press R/S to execute the conversion. See the Conversion Function Description for conversion codes. As an additional indication that alpha data is required, the small annunciator "ALPHA" will appear in the display at the same time as the input prompt.

The names sought will be names of navigation fixes, airports, or intersections. Any input of up to six characters will be processed, but it is best to limit to three characters simply because this makes for neater displays. Three letters is usually sufficient, because all VORTACs and NDBs have three letter radio call signs by which they can be identified. Similarly, all airports have three letter identifiers associated with them. For

intersections you can use the first three letters of the intersection name. Try using more than three letters if you like to see whether the displays which result are acceptable to you. If they are, by all means use more than three letters.

Simple Arithmetic

You should have some ideas of how to do simple arithmetic from your reading of Sections 2 and 3 in the HP Owner's Handbook and Programming Guide. If you wish to do anything more sophisticated than add, subtract, multiply, or divide (such as take square roots), you should press the USER button to take the calculator out of USER mode ("USER" annunciator extinguished) first, and you may wish to remove the overlay. For simple problems this is not required. Return to USER mode by pressing USER again for AV1 functions.

There are 130 functions available in the HP41C. To find out about them read Sections 4, 5, and 6 in the HP Owner's Handbook and Programming Guide. Remove the overlay from the keyboard and take the calculator out of USER mode to access these functions.

The major distinction between simple arithmetic and AV1 functions is that in the latter case, each data entry is terminated by R/S. In simple arithmetic, each data entry is followed by ENTER or one of the arithmetic operation keys. In AV1 functions, the display is formatted for you. In simple arithmetic no labels are given. You select the number of decimal places you need to view with the FIX function (see the FIX Function Description).

THE AV1 AVIATION FUNCTIONS

Using the Aviation Functions

The AV1 supplies 36 aviation functions in addition to the basic HP41C functions. Thirty-five of these are programmed in the read-only memory (ROM) module, and one, the weight and balance function, is programmed in the random access memory (RAM) of the machine. Functions are divided into two types. These are "computer" functions and "logging" functions. Logging functions are all the functions associated with the maintenance of the electronic flight log within the AV1. Logging functions have gold overlay labels. This means that all logging functions are accessed by pressing the gold key first and then the key beneath the desired gold label. Computer functions, so called because they are the typical flight computer functions, are labeled in white. Computer functions are, therefore, accessed by pressing the key directly above the desired white label.

The RESET function is a gold labeled function although it is used in conjunction with any other function. The FIX function is not an AV1 function. It is a basic HP41C function which you may use. It is, therefore, included on the overlay. The WT/BAL function is gold labeled but is not associated with logging. It was assigned to the shifted "4" key simply because that key was available.

All AV1 functions are summarized in Table II.

The "Computer" Functions

The computer functions include unit conversions (CONV), great circle navigation (NAV), time and distance functions (TIME/D), wind functions (WIND) and true airspeed and density altitude functions (TAS). All the computer functions (except CONV) contain two or more "subfunctions". Subfunctions are separate but related functions. For example, TAS contains the subfunctions TAS and DA. These are, respectively, the true air speed (TAS) and density altitude (DA) subfunctions which have related software. When TAS is pressed (as you did in the sample problem) the display shows "TAS:DA" indicating that these are the two subfunctions. Note that the two subfunction codes are separated by a colon (:) and that the keyboard overlay has arrows leading up from the top row of keys towards the display. The arrows are separated by colons (:) as well. These markings indicate that the top row of keys is labeled by the display, i.e., that the label for the first key in the top row (the one with the blue "A") is TAS (in the example at hand) and that the label for the second key is DA. To select either of the subfunctions press the corresponding key. In the current example, to do a TAS problem, press the A key. To do a DA (density altitude) problem press the B key. If other computer function keys are pressed, the display will label the top row of keys with other

labels. Table II shows which functions are associated with each of the subfunction labels. The main function name is listed followed by the subfunction. For example, the functions TAS and DA are both subfunctions of the key TAS. They are tabulated, respectively, as TAS:TAS and TAS:DA. The symbol to the left of the colon is the function key which is pressed to access the subfunction group associated with that key. The symbol to the right of the colon is the label for the key in the top row which must be pressed to access the subfunction.

The Flight Data Logging (GOLD Labeled) Functions

We have mentioned that the white labeled functions are the normal flight computer functions and that the gold labeled functions are associated with flight data logging. One of the principal features of the system is its ability to maintain an entire flight log in its memory. By very simple data entry operations you are able to maintain a timely log with a history of all achieved ATA's and realized ground speeds, plus estimated times of arrival for all fixes and the destination. These ETA's may be based upon ground speeds realized earlier in the flight, ground speeds which you estimate or obtain by other means (e.g. DME readout) or wind direction and velocity which are obtained by your measurements and computations, forecasts, or a combination of both.

Table V shows the flight log (we use the terms "flight plan" and "log" interchangeably in both this manual and the Applications Guide) in the format maintained by the AV1. It is similar in format to many of the preprinted forms that one purchases or makes himself on the office copying machine. Only the essential data items are contained in the log. These are the checkpoint name, the course to the checkpoint, the distance to it, the time at the checkpoint, and the ground speed. Each checkpoint is (usually) a radio navigation aid such as a VORTAC but could in fact be any convenient fix along the proposed route of flight, such as an RNAV waypoint, an intersection, or even a VFR fix. We have chosen to name these checkpoints "waypoints" for the simple reason that is is conveniently abbreviated by "WPT". Whenever "WPT" is seen in the text of the manuals or the display, it simply means one of the flight route checkpoints, whatever the nature of that checkpoint. Note from the figure that the checkpoints are numbered from one to nine. There is also a zero checkpoint. This is the departure point (usually an airport). Each waypoint other that the zero waypoint terminates a leg of the flight, e.g., the first checkpoint defines the end of the initial leg of the flight, from the departure airport to the first checkpoint. Thus each waypoint number (other than zero) can be interpreted as a leg number.

Each horizontal line of the flight log contains the data associated with the leg whose number appears in the left most column. With reference to the example data in Table V, Leg 2 is terminated by the LINDEN (California) VORTAC. Its call sign is LIN and so LIN appears in the name column for the leg. The

time column shows the time of arrival at the waypoint (in the example, 13:51:00 is the time of arrival at LIN). This time may be an Actual Time of Arrival at the waypoint as logged by you in flight (using the ATA function). In this case, the log will show an A after the time. Conversely, the time in the log for a given waypoint may be followed by an E which means that the time shown is an Estimated Time of Arrival (ETA) for that waypoint. The third column in the log shows the course to the waypoint. In the example of Table V, the course from SCK to LIN is 012°. This course may be either magnetic or true, but you will most probably want to use magnetic since magnetic courses are given on the charts for published airways. You may use true course if you like so long as you remember to always specify true wind direction when using the N WIND function in conjunction with the log. Conversely, if you use magnetic courses, you must remember to convert forecast winds to magnetic before using the N WIND function. Magnetic courses are probably best for the additional reason that the most accurate estimates of ETA's are obtained by using wind information that you determine in flight using the WIND function. This wind determination is made from the OBS indication or airway course obtained from the map (both referenced to magnetic north) and the magnetic heading actually flown to maintain that course. The winds so determined, which you then use with the N WIND function are therefore referenced to magnetic north.

The fifth column of the log gives the distance from the previous waypoint to the waypoint named in the same line. For example, from Table V, the distance to LIN is 16 miles, that is, it is 16 miles from Stockton (SCK) to Linden (LIN).

The sixth column of the log gives the ground speed for the leg. It is the ground speed upon which the time at the waypoint which terminates the leg is based. If the time at the waypoint is an Actual Time of Arrival (ATA) logged by you (as indicated by an "A" in the third column) then the ground speed is the actual ground speed realized between the waypoint and the previous waypoint at which an ATA was logged. This usually means the previous waypoint, but if you have omitted to log an ATA for that waypoint, it will be the waypoint before that and so on. In the example, it may be the departure point. The Actual Time of Departure (ATD) is considered to be an actual time for purposes of ground speed computation.

If the time at the waypoint is an estimated time (as indicated by an "E" in the third column) then the ground speed is the one that was used to compute the estimate. Such ground speeds are either entered by the user, computed by the system based on ATAs at previous waypoints, or computed by the system based on new wind data entered by the user.

The gold labeled functions are used to enter, modify, view, and update the flight log. The use of each of the functions is detailed in the Function Summaries which follow. We give

a brief overview here and encourage you to work through the examples in the Applications Guide.

The second row of keys (from the top) shows the gold labels NAME, TIME, CRS, DIST, and GRD SPD. These are abbreviations for the log column headings and are in the same order. Pressing these keys (gold key first) allows you to observe the data in the log for one leg of the flight log. Each data element appears in the display (the waypoint number is always shown with the data) when the key is pressed. In order to select the line of the flight log you wish to view, the gold functions FIND, P UP, and P DN are used. One should picture the flight log in the system as in Table V. On the figure, there is a "pointer" (shown pointed to line two). You view the individual data items in the line pointed to by the pointer with the NAME, TIME, CRS, DIST, and GRD SPD keys. To move the pointer to another line you use the P UP (pointer UP), P DN (pointer down) or FIND Keys. The first two move the pointer, respectively, up or down one line. The FIND function key moves the pointer directly to a specified line. The line is identified either by the waypoint name or number. With a little practice, which you can obtain by working through the examples in the Applications Guide, you will discover that it is trivially simple to access any piece of log data you may wish to view.

If you have purchased the printer, you may obtain a printout of the entire plan (except for the courses) with the SMMY key or any single line with the PRINT key. For details of any or all of these functions, refer to the Function Summaries which follow.

The original flight log data is entered into the system via the INIT (INITialize) function, or, if you have the card reader and have a prerecorded flight plan (very useful if you make the same flight often), you may more simply enter the data via the CARD function. The input flight log data may be modified (any single item) with the CHANGE Key. An entire line (waypoint) may be inserted with the INS (INSert) key, or deleted with the DEL (DELete) key. You are thus able to easily accommodate in-flight reroutings.

The Actual Time of Departure (ATD) is entered via the ATD key.

The ATA (Actual Time of Arrival) is the most powerful of the gold function keys. Using the ATA key, you record in the system log the ATA at each waypoint as it is reached. The computer will log that ATA as the time at the waypoint and then review the entire flight log. It will search back through the flight plan to find the last waypoint at which an ATA has been previously logged. The ground speed from that waypoint to the current waypoint is computed. This means that if you did not log the ATA at one or more previous waypoints you may still obtain a ground speed reading. The AV1 also computes the average ground

speed for the entire flight from the departure point to the current location. Both these ground speeds are displayed. The system then checks to make sure that the estimated times of arrivals for any previous waypoints at which you have omitted to log an ATA are consistent with the just determined ground speed so that, if for example, you did not log the ATA at the waypoint before the current one, the time shown for that waypoint will be the time you most probably got there based on the ground speed to the current checkpoint. The AV1 will also let you go back and log a previously omitted ATA at any time in which case it corrects all affected log data to reflect the new information.

Finally, the ATA function causes the system to predict times of arrivals for all waypoints beyond the current waypoint (but not beyond any subsequent waypoint for which an ATA has been previously logged) using the most current ground speed.

The DTG (Distance To Go) function displays the distance to the destination and time to the destination (last waypoint in the log) from the waypoint to which the pointer is positioned. It is automatically executed after ATA when the printer is attached.

The N GS (New Ground Speed) function permits you to enter any ground speed and compute ETAs at all waypoints for which ATAs have not been logged.

The N WIND (New WIND) function permits you to enter new wind speed, direction, and TAS or process data already in the memory to get new ETA's for all waypoints which do not already have logged ATA's. Winds data from exercise of the WIND function may be transferred via the memory.

The RECORD function permits recording of flight logs on magnetic cards (card reader required).

Logging functions are tabulated in Table II in the same way as computer functions, i.e., by their key labels. There are no logging subfunctions.

FUNCTION SUMMARIES

The following pages contain Function Summaries for each of the 37 functions and subfunctions of the AV1 computer. For user convenience, Tables I-VI at the beginning of this manual give a function directory (Table I), Function Summary (Table II), both with page number references to this section, a table of input and output formats (Table III), the list of abbreviations used (Table IV), the flight log format (Table V), and a list of system messages (Table VI) (with their interpretations). This section of the manual with the tables collects everything you should need to reference in using the computer after you have read the text. With a little familiarity, you should not even need the reference material, since the AV1 is self prompting and self documenting.

Each Function Summary gives the function key label, gives a summary of what the function does, and shows how the user interacts with the system to execute the function. If the function is a subfunction, the main function and subfunction are given in that order separated by a colon (:), just as in Tables I and II.

Each subfunction has a separate function summary.

The interaction is a detailed sequence of steps that the user follows to work through the function selected. Each key which must be pressed is indicated. Each resultant display is shown. Portions of displays change from execution to execution of a function according to the results of a particular computation. These are symbolized by lower case letters which are interpreted in the comments column of the interaction table. As an example, "TAS=sss.sKT" indicates that a value for true airspeed is displayed. TAS, the equals sign, and KT will always appear exactly as shown. A numerical value for TAS will also appear symbolized by sss.s which means a speed number with one decimal place. Examples are sss.s=125.4 sss=456.7, etc. In the first case, the display would show "TAS=125.4KT" and in the second "TAS=456.7KT".

Each step in the interaction table is numbered and the steps should be followed in sequence unless you are instructed to depart from the sequence by the comments. This will be the case where more than one option is presented. When the INPUT column shows an entry, this is the type of data that is to be entered. Enter the data and then go to the next step unless directed otherwise. Note that the next step to be executed after a data entry will always be an R/S. This is the R/S which terminates the data entry and restarts computing. Therefore, where data entry is called for you do not press R/S until told to do so in the next line.

If you are executing a subfunction, the interaction table will ask you to press the labeled key with the function name

on it first. The second step will indicate that you should press a key labeled A, B, C, D, or E. These letters refer to the blue letters on the sloping front of the key itself. The key is in the top row of keys and is immediately under the display label for the subfunction. When you press this key, the display will show "XEQ A" (for example) briefly, and the printer, if attached, would print that same message.

At the end of this guide (Appendix A) is a set of reproductions of printer tapes for each of the functions. If the function has several options, a printer interaction exemplifying each option will be presented. These tapes will be of benefit to the user without the printer as well as the user with. Each tape interaction is a completely documented example of the particular function. Each tape example starts with the notation XROM "XYZ" where XYZ represents a code of from one to three letters. This code is the AV1's internal name for the function which may or may not resemble the function label. As you become more adept with the HP41C itself, should you choose to do so, you will come to realize that these codes will permit you to access any of the programs as subroutines in programs of your own which you may write.

Printer interactions differ from non-printer interactions in the following respects:

1. The functions PRINT and SMMY are only possible with the printer attached.

2. Functions which require pressing R/S to continue without the printer do not require this when the printer is attached. The result will be printed and execution will continue automatically. "RUN" will not appear on the tape in these cases.

3. The functions DTG and SMMY are automatically executed after ATA when the printer is attached.

Let us now repeat the sample problem that we did earlier and follow through on the function summary for TAS:TAS (page 49). As the first step, the interaction table tells us to press TAS and indicates that the display should show "TAS:DA". The comments indicate that TAS and DA are labels for the top row A and B keys, respectively. The second step indicates that we should press the A key, the first one in the top row underneath the label "TAS". Doing this gives the display "*CAS=?" As before, enter 124 kt by pressing the keys 1, 2, 4 (no R/S yet). Step 3 indicates that we should press R/S so do that now. The display shows "*PR ALT=?" and the input column says we should enter the pressure altitude. As before enter 12000 feet by pressing 1, 2, 0, 0, 0. Step 4 indicates that we press R/S. Do so and, after a moment of processing,the display shows "M=0.2348 R". The display column of the table indicates a display of this format with m.mmmm symbolizing the 0.2348. The comments column explains what m.mmmm means

and instructs us to continue with Step 5 which tells us to press R/S. Doing this gives the display "TAT=?(C)" and the input column says that we should enter the True Air Temperature in degrees Centigrade, but the comments column indicates that we may either do this and skip to step 9 or we may simply go to the next step (step 6). As before, we choose this latter option and, as directed by step 6, press R/S. The display column indicates a display of "IAT=?(S)" and the input column indicates that Indicated Air Temperature is desired, but again, the comments column indicates an option. Either we enter an IAT and go to step 7 or go to step 8 without entry. As before, we choose the former option and enter -10 (1, 0, CHS), then go to the next step as instructed. Step 7 indicates that R/S should be pressed. Doing so causes the AV1 to compute and display "TAT=-12.9R". The comments column shows that this display is the True Air Temperature and directs us to skip to step 9 where we are told to press R/S. Doing so results in the display "TAS=147.4KT" which is interpreted in the comments column. Since there are no specific instructions as to which step to go to now, we go to the next step, step 10, and press R/S which resets the system as indicated by the "KEY?" display.

This same problem as worked out with the printer is shown at the end of the function summaries.

The function summaries make dull reading. They are given as the only practical means of documenting in detail the sequence of interactions for each function. You may wish to proceed to the examples in the Applications Guide rather than studying the function summaries at this time. You may then return to review the Function Summaries later. You should do this eventually so that you will be familiar with all the functions of your AV1 computer.

CONV

FUNCTION: Converts units and computes communication range.

DESCRIPTION:

Converts Fahrenheit degrees to degrees Centigrade (C), feet to meters (M), meters to feet (F), nautical miles to statute miles (SM), statute miles to nautical miles (NM), and feet of altitude to approximate communications range in nautical miles (NM). The conversion performed is determined by a two letter conversion code.

INTERACTION:

STEP	KEY	DISPLAY	INPUT/UNITS	COMMENTS
1.	-	-	xx.x	Value to be converted in °F, ft., m., sm., or nm.
2.	CONV	CONVERSION?	cc	cc = two letter code: FC = Fahrenheit to Centigrade FM = feet to meters MF = meters to feet NS = nautical to statute miles SN = statute to nautical miles FR = feet AGL to approximate VHF communications range
3.	R/S	yyy.yss		yyy.y = converted value ss = abbreviation for new units
4.	R/S	KEY?		Optional.

COMMENTS:

Any other conversion you desire may be programmed by you. See Applications Guide.

NAV:DST

FUNCTION: Computes great circle distance and course between any two points.

DESCRIPTION:

Requests input of source point latitude (LAT SRC) and longitude (LON SRC); and destination latitude (LAT DST) and longitude (LON DST) and computes the great circle distance (DST) between them and the initial course (CRS).

INTERACTION:

STEP	KEY	DISPLAY	INPUT/UNITS	COMMENTS
1.	NAV	DST:PLT:PT		Labels for top row of keys.
2.	A	*LAT SRC=?	LAT SRC/ dd.mmss	Example: 12° 13' 27"S is entered as -12.1327
3.	R/S	*LON SRC=?	LON SRC/ dd.mmss	Example: 45° 27' 15"W is entered as 45.2715
4.	R/S	*LAT DST=?	LAT DST/ dd.mmss	
5.	R/S	*LON DST=?	LON DST/ dd.mmss	
6.	R/S	DST=ddd.dNMR		ddd.d = great circle distance in nautical miles
7.	R/S	CRS=ccc.cT		ccc.c = initial course in degrees referenced to true North
8.	R/S	KEY?		Optional

COMMENTS:

North Latitude and West Longitude are entered as positive numbers. South Latitude and East Longitude are entered as negative numbers. All great circle calculations are in terms of true North and distances are in nautical miles. See the Applications Guide for an explanation of great circle navigation.

NAV:PLT

FUNCTION: Permits plotting of great circle courses.

DESCRIPTION:

This function is initialized by NAV:DST or NAV:PLT. Function requests input distance (DIST) and computes the latitude (LAT) and longitude (LON) of the point the specified distance from the source point (from NAV:DST or NAV:PT) along the great circle. The course (CRS) required to stay on the great circle at this new point is also computed.

INTERACTION:

STEP	KEY	DISPLAY	INPUTS/UNITS	COMMENTS
1.	NAV	DST:PLT:PT		Labels for top row of keys.
2.	B	DIST=ddd.dd?	DIST/nm	ddd.dd = distance in memory. To use this value, go to step 3. Otherwise, enter new value and go to step 3.
3.	R/S	LAT=dd.mmc R		dd = latitude degrees mm = latitude minutes c = N for North, S for South Example: 21.14N = 21°14' North
4.	R/S	LON=dd.mmc R		dd = longitude degrees mm = longitude minutes c = E for East, W for West
5.	R/S	CRS=ccc.cT		ccc.c = new course, degrees true, required to stay on great circle
6.	R/S	KEY?		Optional.

COMMENTS:

See Applications Guide for explanation of great circle navigation and applications to flight planning. Use only after NAV:PLT or NAV:PT. May be used as many times as desired after a single initialization. Note that great circle course changes with distance.

NAV:PT

FUNCTION: Initializes NAV:PLT with a source point and course.

DESCRIPTION:

Requests an initial course (CRS) and the latitude (LAT SRC) and longitude (LON SRC) of a source point. Since NAV:PT is only used to initialize NAV:PLT, execution of NAV:PT transfers execution to NAV:PLT automatically.

INTERACTION:

STEP	KEY	DISPLAY	INPUT/UNITS	COMMENTS
1.	NAV	DST:PLT:PT		
2.	C	CRS=ccc.c?	CRS/°T	ccc.c = course in memory in degrees true. To use this value go to step 3. Otherwise, enter new value and go to step 3.
3.	R/S	*LAT SRC=?	LAT SRC/ dd.mmss	See NAV:DST for input format.
4.	R/S	*LON SRC	LON SRC/ dd.mmss	
5.	R/S	DIST=ddd.d?		ddd.d = distance in memory in nautical miles. To use this value go to step 6. Otherwise, enter new value and go to step 6.
6.	R/S	LAT=dd.mmc R		dd = latitude degrees mm = latitude minutes c = N for North, S for South Example: 21.14N = 21° 14'N.
7.	R/S	LON=dd.mmc R		dd = longitude degrees mm = longitude minutes c = W for West, E for East
8.	R/S	CRS=ccc.cT		ccc.c = new course, °T, required to stay on great circle.
9.	R/S	KEY?		Optional.

COMMENTS:

Steps 5-9 are same as for NAV:PLT. Use NAV:PLT as many times as desired after NAV:PT.

TIME/D:GS

FUNCTION: Computes speed from distance and time.

DESCRIPTION:

Requests a value for distance (DIST) between two points and the Actual Time Enroute (ATE) between them. If ATE is not supplied, it is computed from the time at the second point (T2) and the time at the first point (T1). Ground speed (GS) is computed.

INTERACTION:

STEP	KEY	DISPLAY	INPUT/UNITS	COMMENTS
1.	TIME/D	GS:ATE:ETA:ΣT		Label for top row of keys.
2.	A	DIST=ddd.d?	DIST/any unit	ddd.d = distance in memory. To use this value go to step 3. Otherwise, enter a new value and go to step 3.
3.	R/S	ATE=?(C)	ATE/hh.mmss	Example input 12:22:33= 12.2233. Enter time and go to step 7. If ATE is not entered, go to step 4.
4.	R/S	*T2=?	T2/hh.mmss	Required input.
5.	R/S	*T1=?	T1/hh.mmss	Required input.
6.	R/S	ATE= hh:mm:ssR		hh:mm:ss = ATE in hr:min:sec
7.	R/S	GS=sss.s		sss.s = GS in same units as in step 2 per hour.

COMMENTS:

Times are based on 24-hour clock. There is no need to adjust for times around midnight.

TIME/D:ATE

FUNCTION: Computes time difference.

DESCRIPTION:

Requests two times, T2 and T1, and computes the difference between them: ATE = T2 - T1.

INTERACTION:

STEP	KEY	DISPLAY	INPUT/UNITS	COMMENTS
1.	TIME/D	GS:ATE:ETA:ΣT		Label for top row of keys.
2.	B	*T2=?	T2/hh.mmss	Enter 12:34:56 as 12.3456.
3.	R/S	*T1=?	T1/hh.mmss	
4.	R/S	ATE=hh:mm:ss		hh:mm:ss = T2-T1 in hr:min:sec.
5.	R/S	KEY?		Optional.

COMMENTS:

May be used to difference any two times. Usually used to difference the time at a second waypoint with the time at an earlier waypoint. This difference is the Actual Time Enroute, hence the label.

TIME/D:ETA

FUNCTION: Computes Estimated Time Enroute and Estimated Time of Arrival.

DESCRIPTION:

Requests ground speed (GS) and distance (DIST) and computes Estimated Time Enroute (ETE) from these values. Then asks for clock time (CLK). Adds ATE to clock time thus computing Estimated Time of Arrival (ETA).

INTERACTION:

STEP	KEY	DISPLAY	INPUT/UNITS	COMMENTS
1.	TIME/D	GS:ATE:ETA:ΣT		Label for top row of keys.
2.	C	GS=sss.s?	GS/any	sss.s = value of ground speed in memory. To use this value go to step 3. Otherwise enter a new value and go to step 3.
3.	R/S	DIST=ddd.d?	DIST/	ddd.d = distance in memory. To use this value, go to step 4. Otherwise, enter new value and go to step 4. Units consistent with units in step 2.
4.	R/S	ETE= hh:mm:ssR		hh:mm:ss = hrs:min:sec ETE
5.	R/S	*CLK=?	CLK/hh.mmss	Current clock time. Enter, for example, 12:34:56 as 12.3456.
6.	R/S	ETA=hh:mm:ss		hh:mm:ss = hrs:min:sec. Estimated Time of Arrival.
7.	R/S	KEY?		Optional.

COMMENTS:

This function may be used to compute time to fuel exhaustion. Substitute fuel quantity (gallons or pounds) for distance in step 2 and fuel flow (gallons/hour or pounds/hour) in step 1.

TIME/D:ΣT

FUNCTION: Adds two times.

DESCRIPTION: Adds times T1 and T2. Displays the sum, ΣT.

INTERACTION:

STEP	KEY	DISPLAY	INPUT/UNITS	COMMENTS
1.	TIME/D	GS:ATE:ETA:ΣT		Label for top row of keys.
2.	D	*T1=?	T1/hh.mmss	Example input: 12:34:56 is entered as 12.3456.
3.	R/S	*T2=?	T2/hh.mmss	
4.	R/S	T=hh:mm:ss		hh:mm:ss = hrs:min:sec total
5.	R/S	KEY?		Optional.

WIND:GS

FUNCTION: Computes ground speed and heading from winds data.

DESCRIPTION:

Requests True Airspeed (TAS), Course(CRS), Wind Direction (WND DR) and Wind Speed (WND SPD). Computes Ground Speed (GS) and Heading (HDG).

INTERACTION:

STEP	KEY	DISPLAY	INPUT/UNITS	COMMENTS
1.	WIND	GS:WND		Labels for top row of keys.
2.	A	TAS=sss.s?	TAS/any	sss.s = TAS value in memory. To use, go to step 3. Otherwise, enter new value. Then go to step 3.
3.	R/S	CRS=ccc.c?	CRS/ T or M	ccc.c = CRS value in memory. To use, go to step 4. Otherwise, enter new value. Then go to step 4.
4.	R/S	WND DR=ddd.d?	WND DR/ T or M	ddd.d = wind direction in memory. To use, go to step 5. Otherwise, enter new value. Then go to step 5. Reference (T or M) must be same as in step 3.
5.	R/S	WND SPD=ss.s?	WND SPD/	ss.s = wind speed in memory. To use, go to step 6. Otherwise enter new value. Then go to step 6. Units must be same as in step 2.
6.	R/S	GS=sss.sR		sss.s = GS in same units as in steps 2 and 5.
7.	R/S	HDG=hhh.h		hhh.h = heading with respect to same refereence as in steps 3 and 4 (T or M).
8.	R/S	KEY?		Optional.

COMMENTS:

See Applications Guide for an explanation of the wind triangle problems and examples of use of WIND:GS.

WIND:WND

FUNCTION: Compute winds from flight data.

DESCRIPTION:

Requests Course (CRS), Ground Speed (GS), Heading (HDG) and True Air Speed (TAS). Computes Wind Speed (WS) and wind Direction (DIR).

INTERACTION:

STEP	KEY	DISPLAY	INPUT/UNITS	COMMENTS
1.	WIND	GS:WND		Labels for top row of keys.
2.	B	CRS=ccc.c?	CRS/°M or °T	ccc.c = CRS in memory. To use, go to step 3. Otherwise enter new value. Then go to step 3.
3.	R/S	GS=sss.s?	GS/any	sss.s = GS value in memory. To use go to step 4. Otherwise, enter new value. Then go to step 4.
4.	R/S	HDG=hhh.h	HDG/°M or °T	hhh.h = HDG in memory. To use go to step 5. Otherwise, enter new value. Then go to step 5. Reference (M or T) must be same as step 2.
5.	R/S	TAS=sss.s?	TAS/	sss.s = TAS in memory. To use go to step 6. Otherwise enter new value. Then go to step 6. Units must be same as in step 3.
6.	R/S	WS=ss.s R		ss.s = wind speed in same units as steps 3 and 5.
7.	R/S	DIR=ddd.d MAG		ddd.d = wind direction. See comments below.
8.	R/S	KEY?		Optional.

COMMENTS:

With reference to step 7 above: although the display is labeled "MAG", the reference is the same as is used to specify course (step 2) and heading (step 4). Since this computation is nearly always performed in flight using course data from an aviation chart or OBS reading, both of which are magnetic, and since heading information is nearly always from a magnetic reference source (i.e., compass or gyrocompass), it is presumed that the reference will be magnetic and the display is so labeled. This label should serve to remind you of this supposition and thus force you to be conscious of the necessity of using consistent units throughout the problem.

TAS:TAS

FUNCTION: Computes TAS, Mach and True Air Temperature.

DESCRIPTION:

Processes Calibrated Air Speed (CAS) and Pressure Altitude (PR ALT) to compute Mach number. Requests True Air Temperature (TAT) and computes True Air Speed (TAS). If TAT is unknown, requests Indicated Air Temperature (IAT) and computes TAT, then TAS. If IAT is not available, supplies Standard Temperature (STD T) for the altitude and computes TAS.

INTERACTION:

STEP	KEY	DISPLAY	INPUT/UNITS	COMMENTS
1.	TAS	TAS:DA		Label for top row of keys.
2.	A	*CAS=?	CAS/kt	Required input.
3.	R/S	*PR ALT=?	PR ALT/ft.	Required input.
4.	R/S	M=m.mmmmR		m.mmmm = Mach number.
5.	R/S	TAT=?(C)	TAT/°C	After entry of TAT go to step 9. If TAT is not entered, go to step 6.
6.	R/S	IAT=?(S)	IAT/°C	After entry of IAT go to step 7. If IAT is not entered, go to step 8.
7.	R/S	TAT=tt.tR		tt.t = TAT in °C. Go to step 9.
8.	R/S	STD T=tt.tR		tt.t = STD T in °C. Go to step 9.
9.	R/S	TAS=sss.sKT		sss.s = TAS in knots.
10.	R/S	KEY?		Optional.

COMMENTS:

Standard Temperature (STD T) is the temperature found in the air at the specified pressure altitude on a standard day. Pressure altitude is the altimeter reading with Kollsman window set to 29.92 in. Computations should be performed with CAS specified in knots. If mph are used for speeds below 150-200 mph, error will be small. Interpret TAS computed as mph. Mach will be in error. Recovery coefficient is 1.0.

TAS:DA

FUNCTION: Computes density altitude or standard temperature.

DESCRIPTION:

Requests Pressure Altitude (PR ALT) and Outside Air Temperature (OAT). Computes Density Altitude (DA). If OAT is not entered, computes the Standard Temperature (STD T) for the pressure altitude entered.

INTERACTION:

STEP	KEY	DISPLAY	INPUT/UNITS	COMMENTS
1.	TAS	TAS:DA		Labels for top row of keys.
2.	B	*PR ALT=?	*PR ALT/ft.	Required input.
3.	R/S	OAT=?(C)	OAT/°C	Enter a value and go to step 5. Otherwise, go to step 4.
4.	R/S	STD T=tt.tR		tt.t = Standard Temperature in °C.
5.	R/S	DA=hhhh.hFT		hhh.h = density altitude in feet.
6.	R/S	KEY?		Optional.

COMMENTS:

If no OAT is entered in step 3, the value for density altitude computed and displayed in step 5 will be the same (within algorithm accuracy) as entered in step 2. Density altitude is the altitude at which air of the density being encountered is found in the standard atmosphere. See the Applications Guide. Standard temperature is the temperature at a given altitude in the standard atmosphere.

NAME

FUNCTION: Displays waypoint name.

DESCRIPTION:

Displays the name and number of the "current" waypoint; that is, the waypoint in the name column of the line to which the pointer is directed.

INTERACTION:

STEP	KEY	DISPLAY	INPUT/UNITS	COMMENTS
1.	NAME	NAMEn.=ccc		n = waypoint number ccc = waypoint name
2.	R/S	KEY?		Optional.

COMMENTS:

Pointer may be positioned to any line by use of P UP, P DN, or FIND functions.

TIME

FUNCTION: Displays waypoint time.

DESCRIPTION:

Displays waypoint number, time at the waypoint (T), either estimated or actual, and a code indicating which.

INTERACTION:

STEP	KEY	DISPLAY	INPUT/UNITS	COMMENTS
1.	TIME	Tn.=tt:tt:ttc		n = waypoint number tt:tt:tt = time at waypoint c = A if time is actual (logged time), and E if time is an estimate.
2.	R/S	KEY?		Optional.

COMMENTS:

Times are displayed with reference to the 24-hour clock. Move pointer to desired line with P UP, P DN, or FIND.

CRS

FUNCTION: Display course.

DESCRIPTION:

Displays course for the leg corresponding to the line in the log to which the pointer is directed.

INTERACTION:

STEP	KEY	DISPLAY	INPUT/UNITS	COMMENTS
1.	CRS	CRSn.=ccc.c		n = waypoint number ccc = course this leg
2.	R/S	KEY?		Optional.

COMMENTS:

Pointer may be positioned to any line by use of P UP, P DN, or FIND functions.

DIST

FUNCTION: Displays leg distance.

DESCRIPTION:

Displays the leg (waypoint) number and the leg length, that is, the distance from the previous waypoint to the waypoint which the pointer is directed.

INTERACTION:

STEP	KEY	DISPLAY	INPUT/UNITS	COMMENTS
1.	DIST	DSTn.=ddd.d		n = waypoint number ddd.d = distance to this waypoint from previous waypoint.
2.	R/S			Optional.

COMMENTS:

Pointer may be directed to any waypoint by use of P UP, P DN, or FIND functions.

GRD SP

FUNCTION: Displays leg ground speed.

DESCRIPTION:

Displays the ground speed to the waypoint at which the pointer is directed from the previous waypoint. If the time for this current waypoint (see TIME) is an actual time (A appended) then the ground speed is the actual ground speed for the leg. If the time is an estimate (E appended) then the ground speed is an estimate based on previous ground speed, winds analysis, or entered value. The estimated time is based on this ground speed.

INTERACTION:

STEP	KEY	DISPLAY	INPUT/UNITS	COMMENTS
1.	GRD SP	GSn.=sss.s		n = waypoint number sss.s = ground speed
2.	R/S	KEY?		Optional.

COMMENTS:

Pointer may be positioned to any waypoint with P UP, P DN, or FIND functions.

ATA

FUNCTION: Processes Actual Time of Arrival (ATA) data.

DESCRIPTION:

In response to input of an Actual Time of Arrival (ATA) at a fix, the ground speed from the previous fix is computed and displayed. The average ground speed for the entire flight up to the current waypoint (for which ATA has just been entered) is computed and displayed. If no ATA was logged previously for the previous fix, algorithm will try the fix before that and so on until an ATA is found. Average ground speed from that fix to the current fix is then computed and displayed. The Actual Time of Departure (ATD) from the airport of origin will be used if no ATAs are found. In this case, the displayed ground speeds will be the same since the leg and flight are both deemed to have originated at the source airport.

The computed leg ground speed is used to compute an estimated time of arrival at each waypoint previous to the current waypoint which does not have an ATA logged and which does not occur before a waypoint which has an ATA logged and an estimated time of arrival for each waypoint after the current waypoint which does not have an ATA logged. Estimates based on valid ATAs are not changed.

The entered ATA is logged as the ATA for the current waypoint.

INTERACTION:

STEP	KEY	DISPLAY	INPUT/UNITS	COMMENTS
1.	ATA	NAME=?	Waypoint name	Enter name and go to step 3 or go to step 2 without entry.
2.	R/S	*WPT NO=?	Number	
3.	R/S	nnn hh:mm:sscR		nnn = waypoint name hh:mm:ss = waypoint time c = A if time is actual c = E if time is an estimate
4.	R/S	*ATA=?	ATA/hh.mmss	
5.	R/S	GS=sss.sR		sss.s = ground speed
6.	R/S	AVG GS=sss.s		sss.s = average ground speed from origin airport
7.	R/S	KEY?		Optional.

COMMENTS:

The newly computed ETAs may be examined by use of the TIME function in conjunction with the pointer moving functions P UP, P DN, and FIND.

If you have the printer attached to your AV1, the DTG and SMMY functions will be executed automatically and results printed.

DTG

FUNCTION: Displays distance and time to destination.

DESCRIPTION:

The pointer is first positioned to the desired waypoint. When DTG is executed, the distance to go (D TO GO) from this waypoint to the destination (last waypoint) is displayed, followed by the time from the present waypoint to the final waypoint (TTG).

INTERACTION:

STEP	KEY	DISPLAY	INPUT/UNITS	COMMENTS
1.	DTG	D TO GO = ddd.dR		ddd.d = distance to final waypoint from present waypoint.
2.	R/S	TTG = hh:mm:ssc		hh:mm:ss = time to the final waypoint from present waypoint. c = E if time is an estimate; A if actual.
3.	R/S	KEY?		Optional.

COMMENTS:

Displayed time is usually an estimate (E display). Function may be used to determine actual times from waypoints to destination after flight is complete. If both waypoint and destination times are actual times, TTG will be displayed as actual time (A).

RECORD

FUNCTION: Record flight log on magnetic cards.

DESCRIPTION:

Card reader is required. Entire flight plan is recorded on two magnetic cards.

INTERACTION:

STEP	KEY	DISPLAY	INPUT/UNITS	COMMENTS
1.				Attach card reader. Computer must be off when this is done. Turn computer on.
2.	RCD	RDY 01 OF 04		Pass card 1, side 1.
3.	-	RDY 02 OF 04		Pass card 1, side 2.
4.	-	RDY 03 OF 04		Pass card 2, side 1.
5.	-	RDY 04 OF 04		Pass card 2, side 2.
6.	-	KEY?		

COMMENTS:

See card reader manual for details on the reader. To pass a card hold it gently by the edges in the right hand. The number one should appear at left end of card. Push gently but firmly into slot on the right hand side of the reader until motor engages and pulls the card through. If display shows MALFUNCTION, repeat. After first passage, turn card around so that numeral 2 is at left end of card. Make sure calculator is turned off before removing card reader. Replace dust cover over Port 4 after removing.

CARD

FUNCTION: Load flight plan data from magnetic cards.

DESCRIPTION:

Card reader required. An entire flight plan is contained on two magnetic cards which are passed through the reader in any order.

INTERACTION:

STEP	KEY	DISPLAY	INPUT/UNITS	COMMENTS
1.				Attach card reader. Make sure calculator is off while attaching. Turn calculator on.
2.	CARD	CARD		Pass card 1, side 1.
3.	-	RDY 02 OF 04		Pass card 1, side 2.
4.	-	RDY 03 OF 04		Pass card 2, side 1.
5.	-	RDY 04 OF 04		Pass card 2, side 2.
6.	-	KEY?		

COMMENTS:

Make sure computer is off before removing reader and replace dust cover in Port 4 after removing. See card reader manual and RECORD function for details on card passage. Display may show RDY prompts in irregular order if cards are passed in irregular order. It does not matter which order cards or sides are read in just as long as all four sides are passed.

CHANGE

FUNCTION: Used to change a flight plan data item.

DESCRIPTION:

Used to change a single flight plan data item. Pointer is directed to line containing the data item first. Then CHANGE is executed. User is directed to press the key for the item he wishes to change. Note that time may not be changed (this can only be done be executing ATA with a new ATA) but may be reset to 00:00:00E. The same is true of ground speed which may only be reset to zero. To change to another value requires use of the N GS function.

INTERACTION:

STEP	KEY	DISPLAY	INPUT/UNITS	COMMENTS
1.	CHANGE	ALTER KEY?		
2.	k	iiin.=vvv?	New Value	k = key for item to be changed; NAME, CRS, or DIST. For TIME or GRD SP go to step 5. iii = NAME, DIST, or CRS. n = waypoint number. vvv = current value. Enter new value and go to step 3 or go to step 3 without input to accept displayed value (no change).
3.	R/S	iiin.=vvv		Symbols same as in step 2 except vvv = new value.
4.	R/S	KEY?		Optional. End.
5.	k	iiin.=vvvR		k = key; TIME or GRD SP. Symbols same as in step 2.
6.	R/S	RESET? or ZERO GS? Y/N	Y or N	Y to reset. Otherwise N.
7.	R/S	KEY?		Optional.

COMMENTS:

Resetting time to 00:00:001E also zeroes Ground Speed. Resetting Ground Speed does not reset time.

P UP

FUNCTION: Moves pointer up one line.

DESCRIPTION:

Each time P UP is executed the "pointer" is moved one line towards the top of the flight plan, that is, it is directed to a row whose waypoint number is one less than the waypoint number to which the pointer is directed before execution.

INTERACTION:

STEP	KEY	DISPLAY	INPUT/UNITS	COMMENTS
1.	P UP	NAMEi.=nnn		i = number of new waypoint nnn = name of new waypoint
2.	R/S	KEY?		Optional.

COMMENTS:

The pointer is now positioned to the line in the flight plan containing the waypoint displayed in step 1. The TIME, CRS, DIST, and GRD SP functions will now display data for this line. Each of these functions will have the new waypoint number as part of the display.

PRINT

FUNCTION: Print one line of the flight plan.

DESCRIPTION:

Printer required. Prints one line of the flight plan excluding the course data. Line printed is the one to which the pointer is directed at execution time.

INTERACTION:

STEP	KEY	DISPLAY	INPUT/UNITS	COMMENTS
1.	PRINT	KEY?		Line is printed. Computer is ready for next task at completion.

FIND

FUNCTION: Used to position pointer.

DESCRIPTION:

Whereas P UP and P DN move the pointer one line of the flight plan at a time, FIND finds the desired waypoint by name or number and directs the pointer to that line.

INTERACTION:

STEP	KEY	DISPLAY	INPUT/UNITS	COMMENTS
1.	FIND	NAME=?	Waypoint Name	Enter name and go to step 3 or go to step 2 without entry.
2.	R/S	*WPT NO=?	Waypoint Number	Required input.
3.	R/S	NAMEi.=nnn		i = waypoint number. nnn = waypoint name.
4.	R/S	KEY?		Optional.

COMMENTS:

Pointer is now directed to line in plan containing waypoint displayed in step 3. All executions of functions NAME, TIME, CRS, DIST, and GRD SP will return data from this line. Each display will contain this waypoint number.

P DN

FUNCTION: Move pointer down one line of flight plan.

DESCRIPTION:

Each time P DN is executed, the pointer is directed to the line of the flight plan one below the line to which it is directed prior to execution, i.e., the current waypoint is increased by one.

INTERACTION:

STEP	KEY	DISPLAY	INPUT/UNITS	COMMENTS
1.	P DN	NAMEi.=nnn		i = number of new waypoint nnn = name of new waypoint
2.	R/S	KEY?		Optional.

COMMENTS:

Pointer is now directed to line in flight plan containing the waypoint displayed in step 1. All executions of functions NAME, TIME, CRS, DIST, and GRD SP will return data from this line. The waypoint number will be included in each display.

WT/BAL

FUNCTION: Computes aircraft loading.

DESCRIPTION:

Weight and balance software is customized for each aircraft. Check that the weight and balance program in your computer matches your aircraft. See the Weight and Balance chapter of this manual. Since software is different for each aircraft, we can only present an example which relates to the program in Table IV in the Weight and Balance chapter. Interaction with your program will be very similar and the difference will be in the number of loads.

INTERACTION:

STEP	KEY	DISPLAY	INPUT/UNITS	COMMENTS
1.	WT/BAL	Nxxxxxx		Nxxxxxx = your airplane number. Brief display. Goes to step 2 automatically.
2.	-	E WT=wwwww		wwwww = empty weight (including engine oil). Automatically continues to step 3.
3.	-	E MOM=mmmmmm		mmmmmm = empty moment, in pounds. Includes engine oil. Automatically goes to step 4.
4.	-	*aaa =?	load/lbs	aaa = name of load. Enter weight.
5.	R/S	*bbb =?	load/lbs	bbb = name of load. Enter weight. Step 5 repeats until all load values have been entered, then goes to step 9.
6.	R/S	OVER GROSS R		Only if loading is over maximum allowable gross weight. Otherwise goes to step 9.
7.	R/S	GR WT = wwww.wR		wwww.w = actual gross weight.
8.	R/S	KEY?		Optional end.

9.	R/S	GR WT = wwww.wR	www.w = gross weight. In limits.
10.	R/S	MOM.= mmmmmm.mR	mmmmmm.m = moment. In-lbs.
11.	R/S	CG=cc.cc	cc.cc = center of gravity, inches.
12.	R/S	KEY?	Optional.

COMMENTS:

Center of gravity will be in inches aft of datum if all moment arms have been specified (and programmed) in the same units.

Test the program against manual calculation before use.

In steps 4 and 5, subcalculations may be performed before pressing R/S. For example, if the two front seat pilots are 185 and 187 pounds, one could enter 372, R/S or 185, ENTER, 187, +, R/S.

N WIND

FUNCTION: Processes new winds data for improved ETA's.

DESCRIPTION:

User specifies wind direction (WND DR), wind speed (WND SPD), and True Air Speed (TAS). The name of a waypoint (or its number) is then entered. The function updates each Estimated Time of Arrival (ETA) at each waypoint occuring after the one named unless the waypoint has an Actual Time of Arrival logged.

INTERACTION:

STEP	KEY	DISPLAY	INPUT/UNITS	COMMENTS
1.	N WND	WND DR=ddd.d?	WND DR	ddd.d = wind direction currently in memory. Enter new value and go to step 2 or go to step 2 without entry to accept displayed value. Reference (i.e., °T or °M) must be same as flight plan course data.
2.	R/S	WND SPD=ss.s?	WND SPD	sss.s = wind speed in memory. Enter new value and go to step 3 or go to step 3 without entry to accept displayed value.
3.	R/S	TAS=sss.s?	TAS	sss.s = TAS in memory. Enter new value and go to step 4 or go to step 4 without entry to accept new value displayed.
4.	R/S	NAME=?	Wpt Name	Enter name and go to step 6 or go step 5 without entry.
5.	R/S	*WPT NO=?	Wpt No.	Required input.
6.	R/S	KEY?		Indicates computation complete and system ready for next task.

COMMENTS:

Units in steps 2 and 3 must be consistent with one another and with the distance units used in the flight plan for distance. For example, if leg distances in the log are in nautical miles, Wind Speed and TAS must be in knots. Wind direction must agree with flight log course reference. If WIND function is used to compute winds for N WND, speed and direction units in that function must be consistent with log units.

A different wind may be used for each leg if desired. Simply execute the function once for each new wind and specify the point from which the wind is to be applied in step 4 or 5. Start with the lowest numbered waypoint.

Use NAME, TIME, CRS, DIST, and GRD SP with the pointer positioning functions to view the updated flight plan. Use PRINT or SMMY if you have the printer to print selected lines or the whole flight plan log.

N GS

FUNCTION: Processes new Ground Speed for updated ETA's.

DESCRIPTION:

In response to entry of a new Ground Speed (GS) and a waypoint name or number, each Estimated Time of Arrival (ETA) at each waypoint after the one entered is updated to represent the time of arrival for this new ground speed. The time at a waypoint is not changed if it is an Actual Time of Arrival (ATA).

INTERACTION:

STEP	KEY	DISPLAY	INPUT/UNITS	COMMENTS
1.	N GS	GS=sss.s?	GS/	sss.s = ground speed in memory. Enter new value and go to step 2 or go to step 2 without entry to accept displayed value.
2.	R/S	NAME=?	Wpt Name	Enter name and go to step 4 or go step 3 without entry.
3.	R/S	*WPT NO=?	Wpt No.	Required input.
4.	R/S	KEY?		Indicates computation complete and system ready for next function.

COMMENTS:

Units of ground speed in step 1 must be consistent with units of distance in flight plan log. For example, if distances are in nautical miles, then GS must be in knots.

A different ground speed may be used for each flight segment. Simply repeat the N GS function once for each new ground speed and specify the point of application for each speed in step 2 or 3 (above). Start with the lowest numbered waypoint.

The new estimates are viewed with the pointer positioning functions and NAME, TIME, CRS, DIST, and GRD SP functions or the log, or parts of it, may be printed with the SMMY or PRINT functions (printer required).

INIT

FUNCTION: Manually initialize (load) a flight plan.

DESCRIPTION:

INIT is used for manual entry of a new flight plan. It erases the entire calculator data set to enable it to accept new data. The function is protected against accidental use by requiring an extra R/S before the memory is cleared. Data for each flight plan item is entered line by line. The number of legs is then summarized and the total distance displayed.

INTERACTION:

STEP	KEY	DISPLAY	INPUT/UNITS	COMMENTS
1.	INIT	R		Protection halt. If you wish to execute INIT go to step 3. If you do not, go to step 2.
2.	RESET	KEY?		Function terminated. End.
3.	R/S	*NO LEGS=?	Number	Number must be 9 or less.
4.	R/S	DEP NAMEO.=?	Name	Name of departure point.
5.	R/S	*NAMEi.=?	Name	i=1 for first waypoint, 2 for second, etc.
6.	R/S	*CRSi.=?	Course	All courses must be to same reference, either magnetic or true North.
7.	R/S	*DSTi.=?	Distance	All distances must be in same units.
8.	R/S	*NAMEj=?		j=I+1. This step is same as step 5. Steps 5, 6, and 7 repeat until data for all legs have been entered. Then goes to step 9.
9.	R/S	LEGS: n. R		n = number of legs.
10.	R/S	DIST: ddd.d		ddd.d = total distance.
11.	R/S	KEY?		Optional.

COMMENTS:

Note that all inputs are required. Failure to provide any of them will abort the function (KEY?) leaving the flight plan memory partially empty. Should this occur inadvertently, you must either restart the function or edit the zero values not entered with the CHANGE function.

If you make an error in data entry for any value, note this and continue with the rest of the log. You can change the erroneous data item later with CHANGE. If you accidentally enter a number of legs which is too small, use INS to add the remaining legs later. If you enter a number of legs which is too large, enter dummy data for these extra legs and then delete them with DEL.

ATD

FUNCTION: Sets Actual Time of Departure.

DESCRIPTION:

Actual Time of Departure (ATD) as stored in memory is displayed. User has option of accepting this value or entering a new one.

INTERACTION:

STEP	KEY	DISPLAY	INPUT/UNITS	COMMENTS
1.	ATD	ATD=hh.mmss?	ATD	Current value of ATD is displayed in same format as that in which new value must be entered. hh=hours mm=minutes, ss=sec. Enter new value and go to step 2 or go to step 2 without entry to accept displayed value.
2.	R/S	ATD=hh.mmss		New value of ATD (may be same as in step 1 display).
3.	R/S	KEY?		Optional.

COMMENTS:

ATD is automatically set to 00:00:00A by function INIT (q.v.). Under these conditions all times are elapsed times. ATD may be set to clock at time of liftoff. Then all times are clock times. Note that changing ATD does not change other times in memory. Therefore, ATA, N GS, or N WND should be run as soon as possible after the ATD is changed. Any actual times logged at waypoints should be reset. This reset would not be done if you had correct actual times logged but discovered that the ATD was incorrect and changed it for that reason. In this case, you should rerun ATA for each checkpoint using the same value of ATA again. This will correct the ground speeds in the memory.

INS

FUNCTION: Insert a line in flight plan log.

DESCRIPTION:

Pointer is positioned to the line after which it is desired to insert a new line. The line number and waypoint name are displayed as a check. Upon continuation with R/S, user is prompted to enter a new line of data as in INIT (q.v.). The new line is inserted after the line to which the pointer was directed at execution and the number of legs is increased by one. An attempt to insert after the ninth leg results in the display "NO ROOM".

INTERACTION:

STEP	KEY	DISPLAY	INPUT/UNITS	COMMENTS
1.	INS	NAMEi.=nnn		Position pointer to correct line first. i=number of line after which new line will be inserted. nnn=name of this waypoint. If this is the correct waypoint, go to step 2. If not, go to step 6.
2.	R/S	*NAMEj.=?	New Name	If i in last step was 9, display will show "NO ROOM". Otherwise, j=i+1 is number of new waypoint. Enter its name.
3.	R/S	*CRSj.=?	Course	j = number of new waypoint. Units must be consistent with other legs (i.e., T or M).
4.	R/S	*DSTj=?	New Distance	j = number of new leg. Units must be consistent with other legs.
5.	R/S	KEY?		Signifies completion. End.
6.	RESET	KEY?		End.

COMMENTS:

Note that all inputs are required. If you fail to provide one of the requested inputs, your flight plan will have that data item missing and the system will terminate with "KEY?". Furthermore, all subsequent data items for that line will also be zeroed out in memory. Therefore, if you fail to complete the entry for any reason you must use the CHANGE function to supply values for the missing data.

INS sets time at the new waypoint to 00:00:00E and the ground speed to zero.

If there are already nine legs in memory, the eighth will become the ninth, the seventh the eighth, etc., and the ninth will be lost.

DEL

FUNCTION: Delete one whole line of the flight plan log.

DESCRIPTION:

The pointer is positioned to the line to be deleted before execution of DEL. The name of the waypoint defining the log name is displayed as a check. When execution is restarted (R/S) the line containing that name is deleted. The number is reduced by one.

INTERACTION:

STEP	KEY	DISPLAY	INPUT/UNITS	COMMENTS
1.	DEL	NAMEi.=nnn		Position pointer to line to be deleted first. i=number of waypoint to be deleted. nnn=name of waypoint to be deleted. If correct waypoint, go to step 2. If wrong waypoint go to step 3.
2.	R/S	KEY?		Indicates complete. End.
3.	RESET	KEY?		DEL aborted. Reposition pointer to correct waypoint and go to step 1.

COMMENTS:

If the line is to be replaced by another line, it may be easier to replace each data item separately with the CHANGE function (q.v.).

FIX

FUNCTION: Determines number of decimal digits displayed.

DESCRIPTION:

This is an HP41C function which may be used frequently if you do a lot of non-AV1 computing with the calculator.

INTERACTION:

STEP	KEY	DISPLAY	INPUT/UNITS	COMMENTS
1.	FIX	FIX_	No. Places	Enter number of decimal places desired. No R/S required.

COMMENTS:

Does not affect the displays of AV1 functions. These are formatted by the AV1 programs.

N TAS

FUNCTION: Auxiliary entry of True Air Speed.

DESCRIPTION:

This function may be used to enter True Air Speed for the N WIND function. Entered value remains in memory until changed.

INTERACTION:

STEP	KEY	DISPLAY	INPUT/UNITS	COMMENTS
1.	N TAS	TAS=sss.s?	TAS/	sss.s = TAS value in memory. Enter new value and go to step 2 or go to step 2 without entry to accept displayed value. Units must be consistent. See N WND.
2.	R/S	KEY?		Complete. End.

COMMENTS:

Will probably be found to be of little use except to note a TAS from, for example, a TASI reading.

SMMY

FUNCTION: Print the flight plan log.

DESCRIPTION:

Printer required. Prints the entire flight plan log with the exception of the course data. The function is executed automatically by ATA and no user interaction is required in that case. Directions here are for manual execution.

INTERACTION:

STEP	KEY	DISPLAY	INPUT/UNITS	COMMENTS
1.	SMMY	KEY?		Make sure printer is connected and turned on. KEY? appears at completion of printing.

RESET

FUNCTION: Resets calculator.

DESCRIPTION:

This function is used to reset the computer to its ready state at any time such as for example if you wish to interrupt a function which is partially complete. If a function is executing and you wish to stop it, press R/S. Then execute RESET. If a function has halted for output and you do not wish to continue the function, press RESET. If a function has paused for input and you do not wish to continue, first check to see if the display annunciator "ALPHA" is present. If it is, press the ALPHA key and then press RESET. If it is not, simply press RESET. If you turn the computer on and do not see the display "KEY?", then press RESET.

INTERACTION:

STEP	KEY	DISPLAY	INPUT/UNITS	COMMENTS
1.	RESET	KEY?		

WEIGHT AND BALANCE SOFTWARE

The majority of the software (program instructions for the calculator) are permanently stored in the ROM module in your system. These instructions can never be changed or destroyed without physically (or electrically) destroying the ROM module. This is not the case with the weight and balance software which is stored in Random Access Memory (RAM). These instructions can be changed or destroyed which means, on the positive side, that ADM Systems can customize the system for each user, and the user can alter the custom program himself if he needs to. The negative aspect of this is that the software can be lost accidentally. The software in RAM is maintained as long as power to the memory is not lost, the memory is not reassigned, and the memory is not reset. As long as the batteries are not removed from the calculator or allowed to go dead while in it, power will not be lost. The batteries should last for up to a year if the calculator is not used, so loss due to dead batteries should never occur unless you put the machine away for a long time and forget about it. The memory will not be reassigned unless you do it while programming the calculator yourself. If you are familiar enough with the HP41C to do this, you will not need the instructions which follow since you have an understanding of how to program and control the memory in the HP41C. You should reenter the instructions that are included on the tape listing supplied with this manual.

The memory may be reset intentionally by you in accordance with instructions in the IN CASE OF DIFFICULTY chapter, or it may reset itself due to a transient or other fault. This usually occurs when you plug or unplug an accessory without turning the calculator and/or the accessory off. If you are reasonably careful, you should never lose your weight and balance software. These instructions are included in case you do.

If you press the gold shift key and then the WT/BAL key and the display shows NONEXISTENT, the weight and balance software may be lost. To check, do the following. Press the USER button so that the annunciator USER is extinguished. Press the XEQ key (next to the gold key) then press the ALPHA button, the letter keys W, B, A and then the ALPHA key again. If the display shows NONEXISTENT, the software is missing, and you will have to reload it following the instructions to be given shortly. If the weight and balance software starts to execute, then it is present and the key assignment has been lost. It should be reassigned following the instructions below (step 20 in the next section).

If you ordered your system from ADM directly it was custom programmed according to the weight and balance data you furnished when you placed your order. If you purchased your system from a dealer, the weight and balance software is in the computer but will be unusable for your airplane. This software will

have to be modified. If you wish, ADM Systems will do the modification for you. Write to us at 1315 Merrie Ridge Road, McLean, VA 22101. Furnish the name of each load and its arm (e.g., front seat: 34", rear seats: 72", etc.), the empty weight and moment for your aircraft and the aircraft maximum allowable gross. We will send you a listing of the appropriate software for your airplane which you will then enter according to the instructions in the section Loading Weight and Balance Software. If you wish to save time, modify the software furnished by yourself following the instructions in the section Modifying Weight and Balance Software. In any case, check the weight and balance software against a manual calculation to be sure you obtain the same result. This is important since you will wish to rely upon your system to give you correct loadings. Reliance depends upon verification. If the results do not check, you will have to modify your software. See Modifying Weight and Balance Software.

If you have purchased the card reader for your system you should record the weight and balance software on a magnetic card following the instructions furnished with the card reader. If you lose the software at any time, you can them simply load it back in via the card reader. The weight and balance software is labeled "WBA"*.

You will find loading and/or modifing the weight and balance software much simpler if you will read over Section 7 and Section 8 in the HP Owner's Handbook and Programming Guide.

Whether you purchased your system with the customized software from ADM or through a dealer, the software shipped with your system is listed on the paper tape in the envelope included with your shipment. If you are reloading correct software, this is the software you should load. If it is to be modified, do so following the directions in the section Modification of Weight and Balance Software.

Loading Weight and Balance Software

In these instructions, groups of letters (e.g. XEQ, ALPHA, CF) are function names on the calculator face or on the keys. If preceeded by "gold key" the function name will be printed in gold above the key you are to press (e.g. CF). Single letters preceeded by ALPHA refer to the blue letters on the key sloping fronts. Commas and periods are for separation in the instructions.

To load lost weight and balance software proceed per the following instructions:

1. Turn calculator off. Failure to do this may damage the ROM and calculator when step 2 is performed.

2. Remove ROM module from Port 2 (Port 1 in CV). Remove plastic keyboard overlay. Key meanings are now given by the functions printed directly on the calculator face and keys.

3. Turn calculator back on. Press XEQ, ALPHA, SIZE, ALPHA, 0, 6, 3. Press USER if USER appears in display. USER should go out.

4. Press XEQ, ALPHA, C, L, P, ALPHA.

5. Press ALPHA, W, B, A, ALPHA. This insures that the software is removed. Display may show "NONEXISTENT".

6. Press gold key, GTO, decimal point key, decimal point key again. Display will flash "PACKING".

7. Press PRGM. Display shows annunciator "PRGM".

8. Press gold key, LBL, ALPHA, W, B, A, ALPHA. This is the first instruction. See the listing tape.

9. Press gold key, FIX, 0. This is the second instruction.

10. Press XEQ, ALPHA, gold key, CLΣ, R, E, G, ALPHA, 0, 0.

11. Press gold key, CF, 2, 1.

12. Press gold key, CF, 2, 2.

13. Press ALPHA, gold key, CLX/A, ALPHA.

At this point you have loaded the first instructions for all weight and balance software. The remainder of the steps on your listing tapes should be loaded, one after the other in the same way. To exemplify further, we will continue to describe the loading of instructions from the sample weight and balance program listed in Table III. Recall that if you make an error while entering a single line, you may delete characters by pressing the back arrow key. This key will also delete an entire instruction once it has been completely entered. The following instructions refer to the steps that follow step 9 in Table VII. Do not load these. They are example instructions.

a. Press 1, 7, 5, 5.

b. Press STO 0, 2.

c. Press ALPHA, E, SPACE (blue, on 0 key), W, T,=(blue on 2 key), ALPHA.

SAMPLE WEIGHT AND BALANCE PROGRAM

```
01♦LBL "WBA"
 02 FIX 0
 03 ΣREG 00
 04 CF 21
 05 CF 22
 06 CLA
 07 "N201RU"
 08 AVIEW
 09 PSE
 10 1755
 11 STO 02
 12 "E WT="
 13 ARCL X
 14 AVIEW
 15 PSE
 16 77480
 17 STO 04
18 "E MOM.="
 19 ARCL X
 20 AVIEW
 21 PSE
 22 "*F.S."
 23 34
 24 XEQ 01
 25 "*RS1"
 26 70.7
 27 XEQ 01
 28 "*BAG"
 29 95.5
 30 XEQ 01
 31 "*HAT"
 32 119
 33 XEQ 01
 34 "*FUEL"
 35 48.43
 36 XEQ 01
 37 SF 21
 38 2740
 39 RCL 02
 40 X>Y?
 41 GTO 00
 42 FIX 1
 43 "GR WT="
 44 ARCL 02
 45 "LR"
 46 AVIEW
 47 "MOM.="
 48 ARCL 04
 49 "LR"
 50 AVIEW
 51 RCL 04
 52 RCL 02
 53 /
 54 FIX 2
 55 "CG="
 56 ARCL X
 57 AVIEW
 58 GTO "X"

 59♦LBL 00
 60 BEEP
61 "OVER GROSS R"
 62 AVIEW
 63 "GR WT="
 64 ARCL X
 65 AVIEW
 66 GTO "X"

 67♦LBL 01
 68 CF 22
 69 "L=?"
 70 PROMPT
 71 FC? 22
 72 GTO "X"
 73 X<>Y
 74 Σ+
 75 RTN
 76 END
```

d. Press ALPHA, gold key, RCL, decimal point key, X (blue letter X), ALPHA. Do not confuse letter x with the multiply key.

e. Press XEQ, ALPHA, P,S,E (blue letter keys), ALPHA.

We have just shown you in detail how to enter each of the first 15 instructions in the example software of Table VII. Just so that you will have been exposed to an example of each type of instruction, the following lines from Table VII are also given:

Instruction No.	Entry
24	XEQ, A (blue letter)
37	gold key, SF (7 key), 2, 1.
39	RCL, 0, 2.
40	gold key, X>Y? (multiply key)
41	gold key, GTO (RCL key), 0, 0.
42	gold key, FIX (1 key), 1
44	ALPHA, RCL, 0, 2, ALPHA.
45	ALPHA, gold key, XEQ, R, ALPHA.
53	divide key
59	gold key, LBL (STO key), 0, 0.
60	gold key, BEEP (4 key)
66	gold key, GTO (RCL key), ALPHA, X, ALPHA.
71	XEQ, ALPHA, F, C, ?(3 key), ALPHA, 2, 2.

We have illustrated at least one instruction of every type that you will have to enter. You will find these instructions much more meaningful if you familiarize yourself with the programming features of the HP-41C/V by reading the Owner's Handbook and Programming Guide. Continue now as below using the tape furnished with your AV1.

14. Enter the remaining instructions from your program listing.

15. Press PRGM. "PRGM" annunciator in display disappears.

16. Press gold key, GTO, ALPHA, W, B, A, ALPHA.

17. Press PRGM. "PRGM" annunciator reappears.

18. Press SST repeatedly. As you do so you will step through the entire set of instructions you have loaded. Compare each with the tape listing. Note that diamonds and quotation marks on the tape do not appear in the display and that the small superscript capital "T" in the display does not appear on the tape. Correct each line in error by deleting it (press the back arrow key) and then reentering it.

19. Press PRGM. Annunciator goes off.

20. Make sure that the "USER" annunciator is extinguished. Press USER if necessary. Press gold key, ASN, ALPHA, W, B, A, ALPHA, gold key, BEEP.

21. Turn system off. <u>This is important</u>.

22. Replace ROM module in port 2. Replace plastic keyboard overlay.

23. Turn system on. Press USER. Display shows "USER" annunciator.

24. Execute and test weight and balance function. If it fails to operate, repeat steps 1, 2, and 16-24 looking carefully for errors. The program steps should be exactly as listed on the tape. If program operates approximately correctly but gives wrong answers, see the section <u>Modifying Weight and Balance Software</u>.

You should have restored weight and balance software at this point. If you have followed the instructions given above as closely as you can but still have difficulty, you may write to ADM Systems at the address given earlier. Tell us what you have done and what the system does when you try to execute weight and balance. Write down exactly what appears in the display as you SST through the program in step 18.

Finally, <u>test your program before flying with it</u>.

Modifying Weight and Balance Software

If you purchased your system from a dealer, the weight and balance software is as given in Table VII which is not correct for your airplane and you will have to modify it. Note that some dealers may be able to help you with this. If you ordered your computer from ADM Systems, you will have the correct software based on the information you supplied. At some later date you may remove or add equipment to your airplane, have it repainted or even buy a new airplane. In these cases you will wish to modify the weight and balance software to account for these changes. To see how this is done, refer to Table VII which is the software listing for N201RU, a Mooney Mark 20J. Empty weight of N201RU is 1755 pounds (includes the engine oil), and the empty moment is 77480 in-lb. There are five loads. Front seats (arm 34"), rear seat (arm 70.7"), baggage compartment (arm 95.5"), hat rack (arm 119"), and fuel (arm 48.43"). The maximum gross weight for M20J is 2740 pounds. If you examine Table VII you will find all these numbers contained in the listing of the program steps. Line 7 contains the empty weight (1755), line 13 the empty moment (77480), line 37 the maximum allowable gross (2740). You will note that lines 23 through 35 are in groups of three lines each. These lines contain the name of the load as abbreviated for display. "*F.S." in line 21 stands for "front seats" and "*RS1" in line 24 for "rear seats, first row". The associated arms of, respectively 34" and 70.7" follow the abbreviations and the third line in each group is XEQ 01.

Three types of modification to this software are contemplated. They are, first, correction of an incorrect number or load label, second deletion of a particular load, and third addition of another load. Details of each are given below. Before any modifcation is possible, the software to be modified must be in the system. The previous section dealt with how to load the software. Assuming that the software is in the computer, the following steps must be performed. See the previous section for interpretation of key labels.

1. Turn the calculator off. Failure to do this may result in damage to calculator and ROM in the next step.

2. Remove the ROM from Port 2 and the plastic overlay from the calculator face. Key functions are now as labeled on the key face or the body of the calculator.

3. Press USER. The annunciator "USER" in the display should go out.

4. Press gold key, GTO, ALPHA, W, B, A, ALPHA.

5. Press PRGM. Display will show a small "PRGM" annunciator and "01 LBL WBA". This is the

first program step. See your listing (or Table VII if you are modifing the Table VII software.

6. Go to one of the following sets of instructions which follow in accord with the type of modification you desire.

To correct a name or number:

A1. Press SST repeatedly until the line to be changed appears in the display.

A2. Delete the line. This is done by pressing the back arrow key.

A3. Reenter the correct data. If a name, press ALPHA, gold key, Y (this enters the *), x, y, z, t, ALPHA. x, y, z, and t represent the correct letters you wish to enter. If the data is numerical, simply press the correct number keys in sequence. Note that if numerals are to be entered as a part of an alphabetic label (e.g. "FSI") the numerals are preceeded by a press of the gold key. "FSI" would be entered as ALPHA, F, S, gold key, I, ALPHA.

A4. Press SST to step to the next line to be corrected or go to step 7 below.

To delete a load:

B1. Press SST repeatedly until the line containing the name of the load appears.

B2. Press SST twice more. The display shows "XEQ 01".

B3. Press the back arrow key three times to delete three lines.

B4. Press SST to position the display to the next load to be deleted, or go to step 7.

To add a load:

C1. Press SST repeatedly until the name of the load after which you wish to enter the new load appears.

C2. Press SST twice more. Display should show XEQ 01.

C3. Press ALPHA, gold key, Y, x, y, z, ALPHA, where x, y, z represent the letters in the new load name.

C4. Press the number keys which represent the new arm values.

C5. Press XEQ, A.

C6. Press SST to position the display to the next load entry or go to step 7.

As further illustration, suppose we wish to enter the load name "*RS2" in either step A3 or C3. This would be done by pressing ALPHA, gold key, Y, R, S, gold key, 2, ALPHA. To enter the new arm 35.5 in either step A3 or C4 press 3, 5, decimal point key, 5.

You should now finalize your modifications by continuing with the following steps:

7. Press PRGM. "PRGM" annunciator extinguishes.

8. Press XEQ, ALPHA, P, A, C, K, ALPHA.

9. Press gold key, GTO, ALPHA, W, B, A, ALPHA.

10. Press PRGM. "PRGM" reappears.

11. Press SST repeatedly to step through the entire program. Write down each program line as you go and checking it for accuracy. This becomes your new record of weight and balance software.

12. Press PRGM. "PRGM" annunciator extinguishes.

13. Turn system off. <u>This is important</u>.

14. Replace ROM and plastic overlay.

15. Turn system on.

16. <u>Test new program</u>. Repeat step 20 in Loading Weight and Balance Software section if necessary.

Note that there is plenty of memory left in your system so that you may add as many additional loads as desired. You must simply be sure that you pick a unique abbreviation for each load so that you know which load is being asked for when the program runs. You may use names of up to 10 characters, but one of them should be the asterisk (*) which signals that the requested weight must be entered or the system will reset (display "KEY?").

IN CASE OF DIFFICULTY

Introduction

There are actually very few things that can go wrong with your AV1 computer. There are several things which may happen which may cause you to think that something is wrong when this really is not the case. The reason that these things can happen is that the HP41C/V is a very versatile machine with many features and modes of operation. The software for the AV1 takes advantage of many of these but is, at the same time, designed to be as simple to use as possible. Nevertheless, you may be able to get the machine into a state which makes it apparently not functional. As you get more familiar with the AV1 this is less likely to happen. Furthermore, if you take the time to familiarize yourself with the HP41C/V itself via the HP manuals shipped with your computer, you will understand what is happening and be able to diagnose and correct situations yourself.

In this chapter we will try to anticipate some of the problems that may arise and specify their solutions. ADM Systems supports its products and will provide free consultation concerning any problems with the AV1. Consultation may be by letter or telephone. Letters should be addressed to:

ADM Systems, Inc.
1315 Merrie Ridge Road
Mclean, VA 22101

Letters should contain a detailed description of the problem. Telephone consultations are on a reply call basis. ADM Systems will call you, collect, in response to your written or telephoned request for a consultation. If you are writing to request telephone consultation, please specifically state that you are authorizing a collect call, give the telephone number and time at which you may be conveniently reached and briefly describe the problem. If you wish to telephone a request for consultation, call (703)527-3810 and leave the same information on the recorder (available 24 hours). We will try to call at as close to your requested time as possible. It will be helpful if you have your AV1 and notes concerning the problem with you when we call.

WARRANTY

Your computer is fully warranted for one year for defects in materials or workmanship. The calculator itself is warranted by Hewlett Packard and may be returned directly to them for warranty service if required. See the HP warranty information in Appendix B of the Owner's Handbook and Programming Guide. The terms of the HP warranty apply.

The AV1 ROM module is manufactured by Hewlett Packard and also warranted by them for defects in materials and workmanship

for one year, but the warranty is to ADM Systems. Therefore, if your ROM module becomes defective you must return it to ADM. We will replace it free of charge, unless it has been damanged physically or by insertion or removal from the calculator with the calculator turned on. Any enquiries that you make to Hewlett Packard concerning the ROM module will be referred to us by them.

No other warranties are expressed or implied including warranties of merchantability and/or fitness for a particular purpose, and ADM Systems shall not be liable for loss of the computer or its components or for other incidental costs, expenses, or damages incurred by the user.

Some states do not allow the exclusion or limitation of implied warranties or consequential damages so the above limitations or exclusions may not apply to you.

This warranty gives you specific legal rights, and you may also have other legal rights which vary from state to state.

Troubleshooting the AV1

In this section we will discuss the potential problems you may meet and some solutions for them. We hope the catalog is exhaustive but realize that it is probably impossible to have it so. We will begin with the most serious problems and work towards less serious ones. The first thing to try in any situation you do not understand is to turn the computer off and then back on followed by pressing RESET.

I. Calculator Does Not Respond to ON Key

Description: The calculator display is blank and remains so when the ON button is pressed, or the calculator is on and cannot be turned off by pressing the ON button. In the latter case there is usually no response to any key.

Interpretation: This usually means that the calculator control microprograms are "hung up" and must be released. This situation may be caused by removing or plugging in a module or accessory with something turned on. Doing this can cause permanent damage, but you will often be lucky and get off with a "hang up".

ACTION: Remove the battery pack for a few seconds (less than a minute) and replace it. Then try the keyboard and/or ON button. If normal operation is not restored and the calculator is off, remove all plug-ins. Repeat the battery removal and replacement. If it is on, first remove the pack. After a few seconds, remove all the plug-ins and then replace the batteries. Try the ON button or keyboard. If normal operation

is restored, suspect one of the plug-ins. Replace them one at a time (making sure that the calculator is off each time you plug in or remove). You may be able to maintain normal operation even with all plug-ins returned. If one of the plug-ins is found to be the cause, refer to its manufacturer for repair or replacement. If it is the AV1 ROM, return it to us. We will advise whether the module is really defective and replace it if it is and is within the warranty period. If you cannot restore normal operation, with or without the plug-ins you will have to try more drastic measures which will result in the loss of weight and balance software. Remove all the plug-ins if the calculator is in the off state. Remove the battery pack and then remove the plug-ins if it is in the ON state. Leave the battery pack out of the computer for at least five minutes. Since the batteries are suspect at this point, replace them with known fresh batteries. Try the ON button and/or keyboard. If there is no response, hold down the back arrow key (fourth key, fourth row) while pressing the ON button momentarily. A display of "MEMORY LOST" indicates successful clearing of the problem. Turn the machine back off, restore the plug-ins and check that they are all right. Refer to part II - Memory Loss Display. If this is unsuccessful and there is still no response, remove the batteries and leave them out overnight. Then replace them and try the keys or ON button. If the calculator responds with a "MEMORY LOST" display, the problem is cleared. Proceed as in part II. If not, the calculator itself is defective and must be returned to Hewlett Packard for repair. After success in cleaning the "hang up", press XEQ, ALPHA, SIZE, ALPHA, 0, 6, 3.

II. Memory Lost Display

Description: The display shows "MEMORY LOST". Computer functions normally otherwise.

Interpretation: The entire non-permanent memory of the calculator has been lost. The batteries have been removed for too long or have been allowed to go dead and then been replaced with good ones, or you have used the back arrow key and ON as a "master clear". Some other situations may also lead to this display.

ACTION: Reload Weight and Balance program per instructions in the Weight and Balance section of this Guide.

III. "KEY?" Display Not Present at Turn-On

Description: The display shows anything other than "KEY?" at turn on.

Interpretation: The computer was not ready for a new function when it was turned off, i.e., it was turned off part way through a previous function. This may have been after a prompt for input or before all of a set of outputs have been displayed. The "KEY?" display may not always appear if the printer is connected at turn-on. In this case, the turn-on display is usually an unlabeled number.

Action: First, wait a moment. If the computer was turned off in the middle of a function, it will try to complete that function and then display "KEY?". If this is the case, the display will show the annunciator "PRGM" and the little airplane symbol may be present. Labeled results of the previous (before turn-off) function may flash in the display. Ultimately, "KEY?" will be displayed. No further action is required.

If the AV1 is not computing at turn-on (PRGM not displayed) the display may show any of several types of partial results from previous computations, small 0, 1, 2, 3, or 4 in the display, etc. Press RESET (gold key) first to clear this situation and restore the "KEY?" display.

IV. Unfamiliar or Meaningless Display

Description: The display shows some unfamiliar or meaningless display.

Interpretation: The display may be legitimate and simply one you do not recognize. This is unlikely, since you will doubtless rapidly become familiar with the AV1 displays, most of which are labeled. Check Tables II through IV and Table VI to see if the displayed information is a function name, AV1 message, or label. If not, you may have invoked an internal HP41C/V function. In these cases the display will show "STO_", "RCL_", "STO IND_ _", or some such message. All of these may be found in the HP manuals, if you are interested.

Action: Press the left-hand arrow key (rightmost in fourth row) or turn computer off and then back on to clear display. Press RESET to restore "KEY?" display.

V. Erroneous Computation Values

Description: The AV1 may display an absurd result such as a negative ground speed from time to time or display shows "DATA ERROR".

Interpretation: You have entered erroneous data. We all make mistakes. The AV1 does not. Some combinations of numbers which you can enter, while physically

meaningless, can cause error. For example, an entered wind speed far in excess of the corresponding TAS may cause an error in the WND:GS function. Entering a checkpoint time which is earlier than a previous checkpoint ATA will cause negative ground speed in the ATA function. You should always have a rough idea of the expected answer in mind so that you will spot absurd results.

Action: Check your input data carefully and review the function to be sure you understand the AV1 prompts.

VI. Absurd Values Displayed During Input Prompt

Description: When prompting for input data in the mode which displays the current memory value of the parameter, an absurd value is displayed. For example, in using N GS you see the display "GS=27400.5?" when you recall computing a ground speed of less than 200 kt previously. The displayed number may be so large as to cause the display to be scrolled off the display panel to the left.

Interpretation: This phenomemon occurs when the blue "A" key is pressed before a function has been selected and after the last function has been terminated. In this case, the blue "A" key is the Σ+ key. It is only assigned its display label when when the labels are in the display. Avoid pressing the blue "A" key except when the display label appears over the key. Memory values for TAS, course, wind direction, wind speed, ground speed, and distance will all be affected by pressing the blue "A" key as described above.

Action: Ignore the situation. Recompute or reenter the reasonable values for the parameters in error that you require using any functions as necessary. The erroneous values may be cleared from the memory and all erroneous values set to zero by pressing the USER button so that the USER annunciator is extinguished. Then press the gold key and the NAME key. Finally, press USER again to restore the USER annunciator.

APPENDIX A

SAMPLE PRINTER OUTPUT

FUNCTION CONV

```
KEY?
            212.0
              XROM "CNV"
CONVERSION?
FC                      RUN
100.00 C


KEY?
          1000.00
              XROM "CNV"
CONVERSION?
FM                      RUN
304.80 M


KEY?
           304.80
              XROM "CNV"
CONVERSION?
MF                      RUN
1000.00 FT


KEY?
           100.00
              XROM "CNV"
CONVERSION?
NS                      RUN
115.15 SM


KEY?
           115.15
              XROM "CNV"
CONVERSION?
SN                      RUN
100.00 NM


KEY?
         10500.00
              XROM "CNV"
CONVERSION?
FR                      RUN
126 NM


KEY?
```

FUNCTION NAV:DST

```
                  XROM "X"


KEY?
                XROM "GCL"
DST:PLT:PT
                      XEQ A


*LAT SRC=?
            39.1000     RUN
*LON SRC=?
            77.1000     RUN
*LAT DST=?
            44.5300     RUN
*LON DST=?
            72.1400     RUN
DST=407.4NMR
CRS=31.1T
```

FUNCTION NAV:PLT

```
KEY?
              XROM "GCL"
DST:PLT:PT
                   XEQ B
DIST=407.39?
             100.00     RUN
LAT=40.35N R
LON=76.02W R
CRS=31.9T



KEY?
              XROM "GCL"
DST:PLT:PT
                   XEQ B
DIST=100.00?
             200.00     RUN
LAT=42.00N R
LON=74.51W R
CRS=32.6T
```

FUNCTION NAV:PT

```
KEY?
              XROM "GCL"
DST:PLT:PT
                   XEQ C
CRS=32.6?
             31.9     RUN


*LAT SRC=?
            40.3500     RUN
*LON SRC=?
            76.0200     RUN
DIST=200.00?
             100.00     RUN
LAT=41.59N R
LON=74.51W R
CRS=32.7T



KEY?
```

FUNCTION TIME/D:GS

```
KEY?

              XROM "TD"
GS:ATE:ETA:ΣT
                   XEQ A
DIST=100.0?
                      RUN
ATE=?(C)
             .3215     RUN
GS=186.0


KEY?
              XROM "TD"
GS:ATE:ETA:ΣT
                   XEQ A
DIST=100.0?
            120.0     RUN
ATE=?(C)
                      RUN
*T2=?
            00.1626     RUN
*T1=?
            23.4500     RUN
ATE= 00:31:26R
GS=229.1
```

SAMPLE PRINTER OUTPUT (CONTINUED)

FUNCTION TIME/D:ATE

```
KEY?
                XROM "TD"
GS:ATE:ETA:ΣT
                     XEQ B
*T2=?
          19.5302     RUN
*T1=?
          15.4242     RUN
ATE= 04:10:20


KEY?
```

FUNCTION TIME/D:ETA

```
KEY?
                XROM "TD"
GS:ATE:ETA:ΣT
                     XEQ C
GS=229.1?
                       RUN
DIST=120.0?
                       RUN
ETE=00:31:26R
*CLK=?
          12.1500     RUN
ETA=12:46:26


KEY?
                XROM "TD"
GS:ATE:ETA:ΣT
                     XEQ C
GS=229.1?
            157.0     RUN
DIST=120.0?
            320.0     RUN
ETE=02:02:18R
*CLK=?
          12.5000     RUN
ETA=14:52:18
```

FUNCTION TIME/D:ΣT

```
KEY?
                XROM "TD"
GS:ATE:ETA:ΣT
                     XEQ D
*T1=?
            12.15     RUN
T2=?
          6.2014      RUN
ΣT=18:35:14


KEY?
```

FUNCTION WIND:GS

```
KEY?
                XROM "WN"
 GS:WND
                     XEQ A
TAS=155.0?
                       RUN
CRS=327.0?
                       RUN
WND DR=253.0?
            187.0     RUN
WND SPD=21.0?
             25.0     RUN
 GS = 173.3R
 HDG = 321.0


KEY?
                XROM "WN"
 GS:WND
                     XEQ A
TAS=155.0?
            185.0     RUN
CRS=327.0?
            245.0     RUN
WND DR=187.0?
            095.0     RUN
WND SPD=25.0?
             27.0     RUN
 GS = 207.9R
 HDG = 240.8
```

FUNCTION WIND:WND

```
KEY?
                XROM "WN"
 GS:WND
                     XEQ B
CRS=245.0?
            327.0     RUN
GS=207.9?
            173.3     RUN
HDG=240.8?
            321.0     RUN
TAS=185.0?
            155.0     RUN
WS=25.1 R
DIR=187.2 MAG


KEY?
                XROM "WN"
 GS:WND
                     XEQ B
CRS=85.0?
            095.0     RUN
GS=165.0?
                       RUN
HDG=335.0?
            105.0     RUN
TAS=155.0?
                       RUN
WS=29.6 R
DIR=209.7 MAG


KEY?
```

SAMPLE PRINTER OUTPUT (CONTINUED)

FUNCTION TAS:TAS

```
KEY?
                XROM "PAH"
TAS:DA
                     XEQ A
*CAS=?
              124.0    RUN
*PR ALT=?
           12000.0    RUN
 M= 0.2348 R
TAT=?(C)
                      RUN
IAT=?(S)
             -10.0    RUN
TAT=-12.9 R
TAS=147.4KT


KEY?
              XROM "PAH"
TAS:DA
                     XEQ A
*CAS=?
              124.0    RUN
*PR ALT=?
           12000.0    RUN
 M= 0.2348 R
TAT=?(C)
             -12.9    RUN
TAS=147.4KT


KEY?
              XROM "PAH"
TAS:DA
                     XEQ A
*CAS=?
              124.0    RUN
*PR ALT=?
           12000.0    RUN
 M= 0.2348 R
TAT=?(C)
                      RUN
IAT=?(S)
                      RUN
STD T=-8.8R
TAS=148.6KT
```

FUNCTION TAS:DA

```
KEY?
                XROM "PAH"
TAS:DA
                     XEQ B
*PR ALT=?
            4572.0    RUN
OAT=?(S)
              32.0    RUN
DA= 7496.9FT


KEY?
              XROM "PAH"
TAS:DA
                     XEQ B
*PR ALT=?
           35000.0    RUN
OAT=?(S)
                      RUN
STD T=-54.3R
DA= 35000.2FT


KEY?
```

FUNCTION NAME

```
KEY?


                XROM "NMK"
NAME5.=HUO
```

FUNCTION TIME

```
KEY?
                XROM "TM"
T5.=20:24:08E
```

FUNCTION CRS

```
KEY?
                XROM "CRK"
CRS5.=53.0
```

FUNCTION DIST

```
KEY?
                XROM "DSK"
DST5.=57.0
```

FUNCTION G SPD

```
KEY?
                XROM "GSK"
GS5.=152.0
```

FUNCTION ATA

```
KEY?
                XROM "AT"
NAME=?
ETX                   RUN
ETX 19:38:13ER
*ATA=?
           19.3710    RUN


GS=169.2 R
FROM GAI TO ETX
AVG GS=148.6
D TO GO=313.R
TTG= 01:51:01E

 WPT   TIME    DST  GS
0GAI 18:35:00A
1EMI 18:55:00A  45 135.0
2LRP 19:28:18A  84 151.4
3ETX 19:37:10A  25 169.2
4ABE 19:59:09E  62 169.2
5HUO 20:19:22E  57 169.2
6ALB 20:50:35E  88 169.2
7CAM 20:59:27E  25 169.2
8MPV 21:28:11E  81 169.2


KEY?
```

FUNCTION DTG

```
                XROM "DTG"
D TO GO=194.R
TTG= 01:16:35E


KEY?
```

SAMPLE PRINTER OUTPUT (CONTINUED)

```
FUNCTION  FIND

              XROM "FND"
NAME=?
                      RUN
*WPT NO=?
               3.     RUN
NAME3.=ETX


KEY?
```

```
FUNCTION  CHANGE

              XROM "CH"
ALTER KEY?
              XROM "CRK"
CRS3.=0.0?
            015.0    RUN
CRS3.=15.0


KEY?
              XROM "CH"
ALTER KEY?
              XROM "TM"
T3.=19:37:10A R
RESET? Y/N
Y                     RUN


KEY?
```

```
FUNCTION  P UP

KEY?
              XROM "UP"
NAME4.=ABE


KEY?
```

```
FUNCTION  P DN

              XROM "DN"
NAME5.=HUO


KEY?
```

```
*FUNCTION  N WIND

KEY?
                 XROM "WD"
WND DR=289.7?
                340.0    RUN
WND SPD=29.6?
                 22.0    RUN
TAS=148.6?
                155.0    RUN
NAME=?
                         RUN
*WPT NO=?
                 3.0     RUN


KEY?
                 XROM "SM"

 WPT   TIME     DST  GS
0GAI 18:35:00A
1EMI 18:55:00A   45 135.0
2LRP 19:28:18A   84 151.4
3ETX 19:37:10A   25 169.2
4ABE 20:04:54E   62 134.1
5HUO 20:28:09E   57 147.1
6ALB 21:05:30E   88 141.3
7CAM 21:15:23E   25 151.9
8MPV 21:49:29E   81 142.5


KEY?
```

```
FUNCTION  INS

              XROM "INS"
NAME3.=ABE R
                      RUN
*NAME4.=?
ABC                   RUN
*CRS4.=?
             123.0    RUN
*DST4.=?
              45.0    RUN


KEY?
```

```
FUNCTION  INIT

KEY?
              XROM "IT"
                      RUN
*NO LEGS=?
               2.     RUN
*DEP NAME0.=?
GAI                   RUN
*NAME1.=?
EMI                   RUN
*CRS1.=?
            037.0     RUN
*DST1.=?
             22.0     RUN
*NAME2.=?
LRP                   RUN
*CRS2.=?
            015.0     RUN
*DST2.=?
             65.0     RUN
LEGS: 2. R
ΣDIST: 87.0


KEY?
```

```
FUNCTION  ATD

              XROM "DT"
ATD=18.3500?
           17.2415    RUN
ATD=17.2415


KEY?
```

*SMMY also show to indicate effect on flight plan.

SAMPLE PRINTER OUTPUT (CONTINUED)

```
*FUNCTION  N GS

KEY?
                XROM "GN"
GS=142.5?
             152.0    RUN
NAME=?
ETX                   RUN


KEY?
                XROM "SM"

 WPT   TIME     DST  GS
0GAI 18:35:00A
1EMI 18:55:00A  45 135.0
2LRP 19:28:18A  84 151.4
3ETX 19:37:10A  25 169.2
4ABE 20:01:38E  62 152.0
5HUO 20:24:08E  57 152.0
6ALB 20:58:53E  88 152.0
7CAM 21:08:45E  25 152.0
8MPV 21:40:43E  81 152.0

FUNCTION  DEL

                XROM "DL"
NAME3.=ETX R
                      RUN


KEY?
```

```
FUNCTION  SMMY

                XROM "SM"

 WPT   TIME     DST  GS
0GAI 18:35:00A
1EMI 18:55:00A  45 135.0
2LRP 19:28:18A  84 151.4
3ETX 19:38:13E  25 151.4
4ABE 20:02:47E  62 151.4
5HUO 20:25:23E  57 151.4
6ALB 21:00:16E  88 151.4
7CAM 21:10:11E  25 151.4
8MPV 21:42:18E  81 151.4


KEY?

FUNCTION  NTAS

KEY?
                XROM "TX"
TAS=157.0?
             185.0    RUN
```

```
FUNCTION  PRINT

                XROM "YI"

 WPT   TIME     DST  GS
2LRP 19:28:18A  84 151.4

FUNCTION  RESET

KEY?
                XROM "X"


KEY?
```