HEWLETT-PACKARD

# HP-67/HP-97

#### Users' Library Solutions

#### Avigation



#### INTRODUCTION

In an effort to provide continued value to it's customers, Hewlett-Packard is introducing a unique service for the HP fully programmable calculator user. This service is designed to save you time and programming effort. As users are aware, Programmable Calculators are capable of delivering tremendous problem solving potential in terms of power and flexibility, but the real genie in the bottle is program solutions. HP's introduction of the first handheld programmable calculator in 1974 immediately led to a request for program solutions — hence the beginning of the HP-65 Users' Library. In order to save HP calculator customers time, users wrote their own programs and sent them to the Library for the benefit of other program users. In a short period of time over 5,000 programs were accepted and made available. This overwhelming response indicated the value of the program library and a Users' Library was then established for the HP-67/97 users.

To extend the value of the Users' Library, Hewlett-Packard is introducing a unique service—a service designed to save you time and money. The Users' Library has collected the best programs in the most popular categories from the HP-67/97 and HP-65 Libraries. These programs have been packaged into a series of low-cost books, resulting in substantial savings for our valued HP-67/97 users.

We feel this new software service will extend the capabilities of our programmable calculators and provide a great benefit to our HP-67/97 users.

#### A WORD ABOUT PROGRAM USAGE

Each program contained herein is reproduced on the standard forms used by the Users' Library. Magnetic cards are not included. The Program Description I page gives a basic description of the program. The Program Description II page provides a sample problem and the keystrokes used to solve it. The User Instructions page contains a description of the keystrokes used to solve problems in general and the options which are available to the user. The Program Listing I and Program Listing II pages list the program steps necessary to operate the calculator. The comments, listed next to the steps, describe the reason for a step or group of steps. Other pertinent information about data register contents, uses of labels and flags and the initial calculator status mode is also found on these pages. Following the directions in your HP-67 or HP-97 **Owners' Handbook and Program Listing I** and Program Listing I and Program Listing indicates on which calculator the program was written (HP-67 or HP-97). If the calculator indicated differs from the calculator you will be using, consult Appendix E of your **Owner's Handbook** for the corresponding keycodes and keystrokes converting HP-67 to HP-97 keycodes and vice versa. No program conversion is necessary. The HP-67 and HP-97 are totally compatible, but some differences do occur in the keycodes used to represent some of the functions.

A program loaded into the HP-67 or HP-97 is not permanent—once the calculator is turned off, the program will not be retained. You can, however, permanently save any program by recording it on a blank magnetic card, several of which were provided in the Standard Pac that was shipped with your calculator. Consult your **Owner's Handbook** for full instructions. A few points to remember:

The Set Status section indicates the status of flags, angular mode, and display setting. After keying in your program, review the status section and set the conditions as indicated before using or permanently recording the program.

REMEMBER! To save the program permanently, **clip** the corners of the magnetic card once you have recorded the program. This simple step will protect the magnetic card and keep the program from being inadvertently erased.

As a part of HP's continuing effort to provide value to our customers, we hope you will enjoy our newest concept.

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Program Title	Great Circle Plotti	ng			
Contributor's Name	Hewlett-Pack	ard Company, HP-6	7/97 Users'	Library	
Address	1000 N. E. Circle B	oulevard			
City Corv	allis	State	OR	Zip Code	97330
Program Description the globe and	on, Equations, Variables an intermediate lon	iven the latitude gitude, this prog	and longit ram calcula	ude of two po tes the lati	oints on tude
Program Descriptic the globe and corresponding	on, Equations, Variables an intermediate lon to the intersection	iven the latitude gitude, this progr of the great circ	and longit ram calcula cle route a	ude of two po tes the lati nd the intern	oints on tude nediate
Program Descriptic the globe and corresponding longitude.	on, Equations, Variables an intermediate lon to the intersection	iven the latitude gitude, this prog of the great circ	and longit ram calcula cle route a	ude of two po tes the lati nd the intern	oints on tude nediate
Program Descriptic the globe and corresponding longitude.	on, Equations, Variables G an intermediate lon to the intersection	iven the latitude gitude, this prog of the great circ LNG <sub>I</sub> (INTERMEN	and longit ram calcula cle route a DIATE LONGITU	ude of two po tes the lati nd the intern DE)	oints on tude nediate

	LNG (INTERMEDIATE LONGITUDE)
	LAT <sub>I</sub> (INTERMEDIATE LATITUDE)
LAT <sub>S</sub> (SOURCE LATITUDE) LNG <sub>S</sub> (SOURCE LONGITUDE)	LAT <sub>D</sub> (LATITUDE DESTINATION) LNG <sub>D</sub> (LONGITUDE DESTINATION) GREAT CIRCLE ROUTE
$LAT_{I} = tan^{-1} \left[ A = (tan(LAT_{D}) cos(LNG_{S})) \right]$ $B = (tan(LAT_{D}) sin(LNG_{S}))$	$\frac{(A - B)}{\sin(LNG_D - LNG_S)}$ -tan(LAT <sub>S</sub> ) cos(LNG <sub>D</sub> )) sin(LNG <sub>I</sub> ) -tan(LAT <sub>S</sub> ) sin(LNG <sub>D</sub> )) cos(LNG <sub>I</sub> )
Operating Limits and Warnings No leg may pa lines of longitude may not be plotted.	ass exactly half way around the earth, and

This program has been verified only with respect to the numerical example given in *Program Description II*. User accepts and uses this program material AT HIS OWN RISK, in reliance solely upon his own inspection of the program material and without reliance upon any representation or description concerning the program material.

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Sketch(es)				

Sample Proble	m(s) On a flight fro	m St. Helena to Bermu	da, what is the latitude a	at
35° 17' wes	st longitude?			
		ΙΔΤ		
	St Helena	<u>ראו</u> 15° 55' S	5° 44' W	
	Bermuda	32° 19' N	64° 51' W	
Solution(s)	LAT <sub>I</sub> = 11° 17' N			
	Keystrokes:		See Displayed:	
	15.55 [CHS] [A] 5.4	4 [B] 32.19 [A]		
	64.51 [B] 35.17 [C]		11.17	
leference (s)				
T	his program is a dire	ct translation of a p	rogram from the HP-65	

		LNGI			5
LAT	LNG	→LAT <sub>I</sub>	_	_	- /

STEP	INSTRUCTIONS	INPUT DATA/UNITS	KEYS	OUTPUT DATA/UNITS
1	Enter program			
2	Input source latitude*	DD.MMSS**	Α	degrees
	and longitude	DDD.MMSS	В	degrees
3	Input destination latitude	DD.MMSS		degrees
	and longitude	DDD,MMSS	В	degrees
4	Input an intermediate longitude and calculate			,
	the corresponding latitude	DDD.MMSS	С	LAT (degrees)
5	For new intermediate point go to step 4, for			
	new case go to step 2.			
	*Southern latitudes and eastern longitudes are			
	expressed as negative values.			
	**DDD.MMSS means degrees, decimal point,			
	minutes and seconds. 120.0713 is 120 degrees.			
	7 minutes and 13 seconds.			

٨				97	Program		sing i			
STEP	<b>у</b> к	EY ENTRY	KEY CODE		COMMENTS	STEP	KEY ENTRY	KEY CODE	COM	MENTS
001	T			T		1				
	001	*LBLA	21 11						1	
	00Z	001 1	10 30 72 91							
	003 001	CTN2	75 92			060				
	004	3702 X#Y	-41						1	
	886	STAT	35 81						1	
	887	RTN	24						4	
	<b>AA</b> 8	#LBLB	21 12						1	
	889	HMS+	16 36						4	
	010	RCL3	36 03				••		4	
	011	ST04	35 04						4	
	012	X≠Y	-41						4	
	013	ST03	35 03			070			4	
	014	RTN	24						4	
	015	*LBLC	21 13						{	
	016	HMS→	16 36						1	
	017	ST07	<b>35 0</b> 7						1	
	018	RCL4	36 04						ł	
	019	RCL1	36 01				<u> </u>		1	
	020	GSBE	23 15						1	
	021	RCL7	36 07						1	
	022	RCL3	36 03						1	
	023	RUL2	36 02			080			]	
	024	65BE	23 15						]	
	020	-	-43							
	020	RUL4	35 84							
	021	RULI	30 0( 75 01							
	020	KULI CCDE	30 01 27 15						]	
	027	63DE	23 13							
	030 071	PLIZ	76 A3						1	
	872	PCI 7	36 87						4	
	033	RCL 2	36 82						4	
	<b>A</b> 34	6SBE	23 15			090			4	
	035	+	-55						-	
	036	RCL3	36 03						4	
	037	RCL4	36 04						ł	
	038	-	-45						{	
	039	SIN	41						1	
	040	÷	-24				FLAGS	1	SET STATUS	
	041	TAN-'	16 43				0		7010	2102
	042	ST08	35 <b>0</b> 8				┼┨	FLAGS	IRIG	DISP
	043	→HMS	16 35			100	<del>1</del> 1'		DEG 🛛	FIX 🛛
	044	RTN	24				2	1 🗆 🕱	GRAD	SCI 🗖
	045	*LBLE	21 15				13	2 🗆 🗙	RAD 🗆	ENG, 🗆
	046		43					3 🗆 🗙		n
	04/	X7Y 000	-41					A		
	048	LUS	42			T		LABE	LS	
	043 050	x V+V	-33		A LAT	в	LNG C	→LAT LNG D		E
	050 051	0+1 QTN	-41		a	b	с	d		e
	<b>A</b> 52	X	-75							4
	<i>и</i> 53	RTN	24		U	<u> </u>	2	3		-
1 -	1		<b>L</b> 7	-	5	6	7	8		9
				1	L			L		

				REGI	STERS	80.121/141/141/141/15/161/0480489/161/84489			
0	<sup>1</sup> LAT <sub>D</sub>	<sup>2</sup> LAT <sub>S</sub>	<sup>3</sup> LNG <sub>D</sub>	<sup>4</sup> LNG <sub>S</sub>	5	6	7	8	9
S0	S1	S2	S3	S4	S5	S6	S7	S8	S9
A	В		С		D	E		I	

Program Title	Rhumb Li	ne Navigat	tion				
Contributor's Na	me Hewle	tt-Packard	d Company	, HP-67,	/97 Users' Lil	orary	
Address	1000 N.	E. Circle	Boulevar	1			
City	Corvallis			State	OR	Zip Code	97330

**Program Description, Equations, Variables** This program accepts the coordinates of two points on the globe and calculates the rhumbline heading (HDG) and distance (DIST) between them. The program inputs are latitude and longitude of the source (LAT<sub>S</sub>, LNG<sub>S</sub>) and latitude and longitude of the destination (LAT<sub>D</sub>, LNG<sub>D</sub>) in degrees, minutes, and seconds. The program outputs are heading in degrees and distance in nautical miles.

Since the rhumb line is the constant heading path between points on the globe, it forms the basis of short distance navigation. In low and mid latitudes the rhumb line is sufficient for virtually all course and distance calculations which private pilots encounter. However, as distance increases or at high latitudes, the rhumb line ceases to be an efficient flight path since it is not the shortest distance between points.

The shortest distance between points is the great circle. However, in order to fly great circles, an infinite number of heading changes are necessary. Since it is impractical to calculate an infinite number of headings at an infinite number of points, several rhumblines may be used to approximate a great circle. The more rhumblines that are used the closer to the great circle distance the sum of the rhumb-line distances will be. <u>Great Circle Plotting</u>, may be used may be used to calculate intermediate heading change points which can be linked by rhumb lines. <u>Operating Limits and Warnings</u>

This program has been verified only with respect to the numerical example given in *Program Description II*. User accepts and uses this program material AT HIS OWN RISK, in reliance solely upon his own inspection of the program material and without reliance upon any representation or description concerning the program material.

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Program Title Rhumb Line Navigation				
Contributor's Name Hewlett-Packard Com Address 1000 N. E. Circle Boulevar City Corvallis	pany, HP-67/97 d State	Users' Lil OR	brary <b>Zip Code</b>	97330
Program Description, Equations, Variables				
GREAT CIRC		EDIATE POINTS CULATED BY AT CIRCLE LOTTING	5	
LAT <sub>D</sub> LNG <sub>D</sub>		LAT <sub>s</sub> LNG <sub>s</sub>		
HDG = $\tan^{-1} \left[ 180(1n \tan(45 +$	π (LNG <sub>S</sub> - LNG 1/2LAT <sub>D</sub> )-1n ta	D) n(45 + 1/2	LAT <sub>S</sub> ))	
DIST = 60 (LAT	– LAT <sub>S</sub> )/cos (	HDG)		
or, if co	os (HDG) = 0			
DIST = 60 (LNG <sub>E</sub>	, - LNG <sub>S</sub> ) cos (	LAT)		
Operating Limits and Warnings No course shoul pole. Errors in distance calculations m approaches zero. Accuracy deteriorates for legs shorter t	d pass through ay be encounte han two or thr	red as the red as the ree miles.	e south or cos (HDG)	• north

This program has been verified only with respect to the numerical example given in *Program Description II*. User accepts and uses this program material AT HIS OWN RISK, in reliance solely upon his own inspection of the program material and without reliance upon any representation or description concerning the program material.

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Sketch(es)				

Sample Problem(s) Find the leg lengths and headings for a flight from St. Helena to Bermuda using the intermediate point calculated in <u>Great Circle Plotting</u>, as an intermediate point of heading change.

		LAT	LNG
	St. Helena	15° 55' S	5° 44' W
	Intermediate	Point 11° 17' N	35° 17' W
	Bermuda	32° 19' N	64° 51' W
Solution			
		DIST	HDG
	LEG 1	2396.39 n.m.	312.92 Degrees
	LEG 2	2065.29 n.m.	307.67 Degrees
Solution(s)	Keystrokes:		See Displayed:
	15.55 [CHS] [A	] 5.44 [B] 11.17 [A]	
	35.17 [B] [C]		2396.39
	[D]		312.92
	32.19 [A] 64.5	1 [B] [C]	2065.29
	[D]		307.67

Reference (s)

This program is a direct translation of a program from the HP-65 Aviation Pac.

<b>[4</b> 1						5
	ΙΔΤ		TSIU			'/
	LAI	LING	<i>~</i> D131	TIDU		

STEP	INSTRUCTIONS	INPUT DATA/UNITS	ĸ	EYS	OUTPUT DATA/UNITS
1	Enter program				
2	Input source latitude*	DD.MMSS**	A		degrees
	and source longitude	DDD.MMSS	В		degrees
3	Input destination latitude	DD.MMSS	A		degrees
	and destination longitude	DDD.MMSS	В		degrees
4	Calculate distance		C		DIST(n.m.)
	and/or heading		D		HDG(deg)
5	If next leg starts at end of last leg go to				
	step 3				
6	For an entirely new case go to step 2				
	*Southern latitudes and eastern longitudes				
	are expressed as negative values.				
	**DDD.MMSS means degrees, decimal point,				
	minutes and seconds. 120.0713 is 120				
	degrees, 7 minutes and 13 seconds.				
			[		
				J []	
			L		
			L	] []	

			97	Program	Lis	ti	ng I			
K	EY ENTRY	KEY CODE	•	COMMENTS	STEP	KE	Y ENTRY	KEY	CODE	COMMENTS
101	≭i BLA	21 11			Ó.	57	RTN		24	
02	HMS→	16 36			8	58	<b>#LBLC</b>	21	13	
103	RCL1	36 01			8	59	GSBD	23	14	
904	ST02	35 <b>0</b> 2			0	60	RCL7	36	07	
005	X≠Y	-41			8	61	RCL1	36	01	
906	ST01	35 01			8	62	COS		42	
907	2	<b>0</b> 2			8	63	х		-35	
908	÷	-24			8	64	RCL1	36	01	
09	4	04	Ţ.		0	65	RCL2	36	<b>8</b> 2	
10	5	05			8	66	-		-45	

STEP

		- · · · [			057	DTH	24	1	
881	*LBLA	21 11			037	KIN	24		
002	HRS÷	16 36			838	<b>#LBLU</b>	21 13		
003	RCL1	36 01			059	GSBD	23 14		
004	ST02	35 02			060	RCL7	36 <b>0</b> 7		
885	XZY	-41			<b>0</b> 61	RCL1	36 01		
995	CT01	75 01			862	201	42		
000	5101	35 01			867		75		
007	2	62			063	× .	-35		
008	÷	-24			064	RCL1	36 01		
<b>00</b> 9	4	04			065	RCL2	36 <b>0</b> 2		
A1A	5	05			066	-	-45		
A11	Ť	-55			867	RCI 8	36 88		
011	TAU	-33			820	000	42		
012	IHN	43			000	605	42		
013	LN	32			69	U	88		
014	RCL5	36 05			070	X≠Y?	16-32		
015	ST06	35 06			071	6SBc	23 16 13		
<b>B</b> 16	X. Y	-41			872	X=Y?	16-33		
010	CTO5	75 05			973	P†	16-71		
017	5103	33 83			013		10 51		
618	RCLI	36 01			074	6	60		
019	RTN	24			875	6	ยย		
020	<b>‡LBLB</b>	21 12			076	x	-35		
R21	HMS+	16 36			077	ABS	16 31		
822	PCI 7	76 07			<b>A</b> 78	PTN	24		
022	RULJ	30 03			970	+ Plo	21 16 17		
823	5104	30 04			073	#LDLC	21 10 13		
024	X≠Y	-41			080	K+	-31		
025	STO3	35 03			081	÷	-24		
826	RTN	24			082	RTN	24		
Ø27	+IRID	21 14			<b>A</b> 83	±l BL d	21 16 14		
021		7/ 04			904	7	A7		
028	KUL4	36 04			007	5	05		
029	RCL3	36 03			885	6	86		
030	-	-45			086	0	88		
031	ST07	35 07			<b>0</b> 87	RTN	24		
031 032	ST07 2	35 07 82			<b>0</b> 87	RTN	24	[	
031 032 077	ST07 2	35 07 02			<b>0</b> 87	RTN	24		
031 032 033	ST07 2 ÷	35 07 02 -24			<b>087</b>	RTN	24		
031 032 033 034	ST07 2 ÷ SIN	35 07 02 -24 41			<b>6</b> 87	RTN	24		
031 032 033 034 035	STO7 2 ÷ SIN SIN⊣	35 07 02 -24 41 16 41			090	RTN	24		
031 032 033 034 035 036	ST07 2 ÷ SIN SIN→ 9	35 07 02 -24 41 16 41 09			090	RTN	24		
031 032 033 034 035 036 036	ST07 2 ÷ SIN SIN→ 9 0	35 07 02 -24 41 16 41 09 00			090	RTN	24		
031 032 033 034 035 036 037 038	ST07 2 ÷ SIN SIN→ 9 0 ÷	35 07 02 -24 41 16 41 09 00 -24			090	RTN	24		
031 032 033 034 035 036 037 038 038	ST07 2 ÷ SIN SIN- 9 0 ÷	35 07 02 -24 41 16 41 09 00 -24 16-24			090	RTN	24		
031 032 033 034 035 036 037 038 039	ST07 2 ÷ SIN SIN→ 9 0 ÷ Pi	35 07 02 -24 41 16 41 09 00 -24 16-24			090	RTN	24		
031 032 033 034 035 036 037 038 039 040	ST07 2 ÷ SIN SIN→ 9 0 ÷ Pi ×	35 07 02 -24 41 16 41 09 00 -24 16-24 -35			090	RTN	24		
031 032 034 035 035 035 037 038 039 040 040	ST07 2 ÷ SIN SIN→ 9 0 ÷ Pi X RCL5	35 07 02 -24 41 16 41 09 00 -24 16-24 -35 36 05			090	RTN	24		
031 032 033 034 035 036 037 038 039 040 041 042	ST07 2 ÷ SIN SIN 9 0 ÷ Pi X RCL5 RCL6	35 07 02 -24 41 16 41 09 00 -24 16-24 -35 36 05 36 06				RTN	24		
031 032 033 034 035 036 037 038 039 040 041 042 043	ST07 2 ÷ SIN- SIN- 9 0 ÷ Pi x RCL5 RCL6	35 07 02 -24 41 16 41 09 00 -24 16-24 -35 36 05 36 05 36 06 -45				RTN	24		
031 032 033 034 035 036 037 038 039 040 041 042 043 044	ST07 2 ÷ SIN SIN-1 9 0 ÷ Pi x RCL5 RCL6 →P	35 07 02 -24 41 16 41 09 00 -24 16-24 16-24 -35 36 05 36 05 36 06 -45 34			<b>887</b> 090	RTN			
031 032 033 034 035 036 037 038 039 040 041 042 043 044	ST07 2 ÷ SIN SIN- 9 0 ÷ Pi x RCL5 RCL6 - →P	35 07 02 -24 41 16 41 09 00 -24 16-24 -35 36 05 36 05 36 06 -45 34 -31			<b>887</b> 090	RTN			
031 032 033 034 035 036 037 038 039 040 041 042 043 044 043	ST07 2 ÷ SIN SIN- 9 0 ÷ Pi × RCL5 RCL6 - →P R↓	35 07 02 -24 41 16 41 09 00 -24 16-24 16-24 -35 36 05 36 05 36 06 -45 34 -31			<b>887</b> 090	RTN			
031 032 033 034 035 036 037 038 039 040 041 042 043 044 045 046	ST07 2 ÷ SIN 9 0 ÷ Pi × RCL5 RCL6 - +P R↓ ST08	35 07 02 -24 41 16 41 09 00 -24 16-24 16-24 -35 36 05 36 05 36 06 -45 34 -31 35 08				RTN			
031 032 033 034 035 036 037 038 039 040 041 042 043 044 045 046 047	ST07 2 ÷ SIN 9 0 ÷ Pi x RCL5 RCL6 - →P R↓ ST08 RCL7	35 07 02 -24 41 16 41 09 00 -24 16-24 -35 36 05 36 05 36 06 -45 34 -31 35 08 36 07				RTN			
031 032 033 034 035 036 037 038 039 040 041 042 043 044 045 046 047 048	ST07 2 ÷ SIN 9 0 ÷ Pi x RCL5 RCL5 RCL6 - →P R↓ ST08 RCL7 SIN	35 07 02 -24 41 16 41 09 00 -24 16-24 -35 36 05 36 05 36 06 -45 34 -31 35 08 36 07 41				ELAGS		CET CTATIC	
031 032 033 034 035 036 037 038 039 040 041 042 043 044 045 046 047 048 049	ST07 2 ÷ SIN 9 0 ÷ Pi x RCL5 RCL6 - →P R↓ ST08 RCL7 SIN SIN <sup>-1</sup>	35 07 02 -24 41 16 41 09 00 -24 16-24 -35 36 05 36 05 34 -31 35 08 36 07 41 10 41 10 41 10 41 10 41 10 41 10 41 10 41 10 41 10 41 10 41 10 41 10 41 10 41 10 41 10 41 10 41 10 41 10 41 10 41 10 41 10 41 10 41 10 41 10 41 10 41 10 41 10 41 10 41 10 41 10 41 10 41 10 41 10 41 10 41 10 41 10 41 41 41 41 41 41 41 41 41 41				FLAGS		SET STATUS	
031 032 033 034 035 036 037 038 039 040 041 042 043 044 045 046 047 048 049 049	ST07 2 ÷ SIN 9 0 ÷ Pi x RCL5 RCL6 − +P R↓ ST08 RCL7 SIN SIN µ µ	35 07 02 -24 41 16 41 09 00 -24 16-24 -35 36 05 36 05 34 -31 35 08 36 07 41 10 41 41 41 41 41 41 41 41 41 41				FLAGS	24	<u>SET STATUS</u> TRIG	DISP
031 032 033 034 035 036 037 038 039 040 041 042 043 044 045 046 045 046 047 048 049 050	ST07 2 ÷ SIN 9 0 ÷ Pi x RCL5 RCL6 - +P R4 ST08 RCL7 SIN SIN 0 Y\Y2	35 07 02 -24 41 16 41 09 00 -24 16-24 -35 36 05 36 05 34 -31 35 08 36 07 41 16 41 00 16 -34				FLAGS	24	SET STATUS TRIG	DISP
031 032 033 034 035 036 037 038 039 040 041 042 043 044 045 044 045 046 047 048 049 050 050	ST07 2 ÷ SIN SIN 9 0 ÷ Pi X RCL5 RCL6 - →P R4 ST08 RCL7 SIN SIN 0 X>Y? 2007	35 07 02 -24 41 16 41 09 00 -24 16-24 -35 36 05 36 05 36 06 -45 34 -31 35 08 36 07 41 16 41 00 16-34				FLAGS	24	SET STATUS TRIG DEG Ø	DISP FIX 🕅
031 032 033 034 035 036 037 038 039 040 041 042 043 044 045 044 045 044 045 046 047 048 049 050 051 052	ST07 2 ÷ SIN SIN- 9 0 ÷ Pi X RCL5 RCL6 - +P R4 ST08 RCL7 SIN- SIN- 0 X>Y? GSBd 23	35 07 02 -24 41 16 41 09 00 -24 16-24 -35 36 05 36 05 34 -31 35 08 36 07 41 16 41 00 16-34 16 14				FLAGS	24 FLAGS 0N OFF 0 0 00 1 0 00	SET STATUS TRIG DEG 🕅 GRAD 🗆	DISP FIX 🕅 SCI 🗆
031 032 033 034 035 036 037 038 039 040 041 042 043 044 045 044 045 044 045 046 047 048 049 050 051 052 053	ST07 2 ÷ SIN SIN- 9 0 ÷ Pi X RCL5 RCL5 RCL6 - →P R↓ ST08 RCL7 SIN- SIN- 0 X>Y? GSB4 23 RCL8	35 07 02 -24 41 16 41 09 00 -24 16-24 -35 36 05 36 05 34 -31 35 08 36 07 41 16 41 00 16-34 16 14 36 08				FLAGS	24 FLAGS ON OFF 0 0 00 1 0 00 2 0 00	SET STATUS TRIG DEG Ø GRAD O RAD O	DISP FIX X SCI I ENG, I
031 032 033 034 035 036 037 038 039 040 041 042 044 042 044 045 044 045 044 045 044 045 044 045 045	ST07 2 ÷ SIN- 9 0 ÷ Pi x RCL5 RCL5 RCL5 RCL5 RCL6 - →P R↓ ST08 RCL7 SIN- 0 X>Y? GSBd 23 RCL8 ABS	35 07 02 -24 41 16 41 09 00 -24 16-24 -35 36 05 36 07 41 16 41 00 16-34 16 14 36 08 16 31				FLAGS	24 FLAGS ON OFF 0 50 1 0 80 2 0 80 3 0 80	SET STATUS TRIG DEG Ø GRAD RAD	DISP FIX X SCI I ENG I n 2
031 032 033 034 035 036 037 038 039 040 041 042 043 044 045 044 045 044 045 045 046 047 048 049 050 051 052 053 054 055	ST07 2 ÷ SIN- 9 0 ÷ Pi x RCL5 RCL5 RCL5 RCL6 → P R↓ ST08 RCL7 SIN- SIN- 0 X>Y? GSBd 23 RCL8 ABS -	35 07 02 -24 41 16 41 09 00 -24 16-24 -35 36 05 36 07 41 16 41 00 16-34 16 14 36 08 16 31 -45				FLAGS	24 FLAGS ON OFF 0 D SF 1 D X0 2 D X0 3 D X0	SET STATUS TRIG DEG 🕅 GRAD 🗆 RAD 🗆	DISP FIX Ø SCI □ ENG □ n 2
031 032 033 034 035 036 037 038 039 040 041 042 043 044 045 044 045 044 045 046 047 048 049 050 051 052 053 054 055	ST07 2 ÷ SIN- 9 0 ÷ Pi x RCL5 RCL5 RCL5 RCL6 → P R↓ ST08 RCL7 SIN- 0 X>Y? GSBd 23 RCL8 ABS - ABS	35 07 02 -24 41 16 41 09 00 -24 16-24 -35 36 05 36 07 41 16 41 600 16-34 16 14 36 08 16 31 -45 16 31				FLAGS	24	SET STATUS TRIG DEG Ø GRAD RAD	DISP FIX Ø SCI □ ENG □ n 2
031 032 033 034 035 036 037 038 039 040 041 042 043 044 045 044 045 044 045 046 047 048 045 045 050 051 052 055 056	ST07 2 ÷ SIN- 9 0 ÷ Pi x RCL5 RCL5 RCL6 →P R↓ ST08 RCL7 SIN- 0 X>Y? GSBd 23 RCL8 ABS - ABS	35 07 02 -24 41 16 41 09 00 -24 16-24 -35 36 05 36 07 41 16 41 00 16-34 16 14 36 08 16 31 -45 16 31		REGIS	090 090 100 100 100 100 100 100 100 100	FLAGS	24	SET STATUS TRIG DEG Ø GRAD RAD	DISP FIX Ø SCI □ ENG □ n_2
031 032 033 034 035 036 037 038 039 040 041 042 043 044 045 044 045 044 045 046 047 048 045 046 047 048 049 050 051 052 053 054 055 056	ST07 2 ÷ SIN SIN- 9 0 ÷ Pi x RCL5 RCL5 RCL5 RCL6 → P R↓ ST08 RCL7 SIN SIN- 0 X>Y? GSBd 23 RCL8 ABS - ABS	35 07 02 -24 41 16 41 09 00 -24 16-24 16-24 -35 36 05 36 05 36 05 36 05 36 05 36 07 41 16 41 00 16-34 16 14 36 08 16 31 -45 16 31 2 1 AT_	<sup>3</sup> LNG-	REGIS	090 090 100 100 100 100 100 100 100 100	FLAGS 6 USED	24	SET STATUS TRIG DEG Ø GRAD RAD RAD	DISP FIX Ø SCI □ ENG □ n 2 9
031 032 033 034 035 036 037 038 039 040 041 042 043 044 045 044 045 044 045 046 047 048 045 046 047 048 049 050 051 052 055 056	ST07 2 ÷ SIN- 9 0 ÷ Pi x RCL5 RCL5 RCL6 - →P R↓ ST08 RCL7 SIN- 0 X>Y? GSBd 23 RCL8 ABS - ABS 1 LAT <sub>D</sub>	35 07 02 -24 41 16 41 09 00 -24 16-24 -35 36 05 36 07 41 16 41 00 16-34 16 14 36 08 16 31 -45 16 31 2 LAT <sub>S</sub>	<sup>3</sup> LNG <sub>D</sub>	REGIS	090 090 100 100 100 100 100 100 100 100	FLAGS 6 USED	24 FLAGS 0 ∩ OFF 0 ∩ DF 1 ∩ M 2 ∩ M 3 ∩ M Z ∩ M	SET STATUS TRIG DEG Ø GRAD RAD B B B B B B B B B B B B B B B B B B B	DISP FIX Ø SCI □ ENG □ n_2 9
031 032 033 034 035 036 037 038 039 040 041 042 043 044 045 044 045 044 045 046 047 048 049 050 051 052 055 056 0 0	ST07 2 ÷ SIN SIN-4 9 0 ÷ Pi x RCL5 RCL5 RCL6 - →P R4 ST08 RCL7 SIN SIN-4 0 X>Y? GSBd 23 RCL8 ABS - ABS 1 LAT <sub>D</sub> S1	35 07 02 -24 41 16 41 09 00 -24 16-24 -35 36 05 36 07 41 16 41 00 16-34 16 14 36 08 16 31 -45 16 31 2 LAT <sub>S</sub> \$2	<sup>3</sup> LNG <sub>D</sub>	REGIS 4 LNG <sub>S</sub> S4	090 090 100 100 100 100 100 100 100 100	RTN FLAGS 6 USED S6	24 	SET STATUS TRIG DEG Ø GRAD RAD B HDG S8	DISP FIX Ø SCI □ ENG □ n 2 9 S9
031 032 033 034 035 036 037 038 039 040 041 042 043 044 045 044 045 044 045 046 047 048 045 046 047 048 049 050 051 055 056 0 0	ST07 2 ÷ SIN SIN-1 9 0 ÷ Pi x RCL5 RCL6 - PP R4 ST08 RCL7 SIN SIN-1 0 X>Y? GSBd 23 RCL8 ABS - ABS 1 LAT <sub>D</sub> S1	35 07 02 -24 41 16 41 09 00 -24 16-24 -35 36 05 36 07 41 16 41 00 16-34 16 14 36 08 16 31 -45 16 31 2 LAT <sub>S</sub> S2	<sup>3</sup> LNG <sub>D</sub> S3	REGIS 4 LNG <sub>S</sub> S4	687 090	RTN FLAGS 6 USED S6	24  FLAGS                                                                                                                                                                                                                                                                                                                                                                                                            _	SET STATUS TRIG DEG Ø GRAD RAD B B HDG S8	DISP FIX Ø SCI □ ENG □ n_2 9 S9

Program Title Grea	t Circle Navigation
Contributor's Name Hew] Address 1000 N.E.	ett-Packard Circle Blvd.
City Corvallis	State Oregon Zip Code 97330
Program Description, Eq	This program computes the great circle distance between two points and computes the initial heading from the first point. Coordinates are input in degrees, minutes and seconds north or south of the equator and east or west of the prime meridian. Outputs are distances in nautical miles and headings in degrees and decimal fractions of a degree.
	DISTANCE
	LAT <sub>D</sub> LNG <sub>D</sub> The great circle distance in nautical miles between two points is given by
	$DIST = 60 \cos^{-1} \left[ \sin LAT_{S} \sin LAT_{D} + \cos LAT_{S} \right]$ $\cos LAT_{D} \cos(LNG_{D} - LNG_{S}) $
	Where $LAT_S$ and $LAT_D$ are the source and destination latitudes and $LNG_S$ and $LNG_D$ are the source and destination longitudes.
	Correspondingly, the initial heading from the source to destination is $HDG = \cos^{-1} \left[ \frac{\sin LAT_{D} - \sin LAT_{S} \cos (DIST/60)}{\sin (DIST/60) \cos LAT_{S}} \right]$ NOTE: If sin (LNGs - LNG <sub>D</sub> ) < 0 then HDG = 360 - HDG
• ··· · · · · · · · · · · · · · · · · ·	Limits and Warnings
Operating Limits and V	Truncation and round off errors occur when the source and destination are very close together (1 mile or less). Input data is in degrees, minutes and seconds, not degrees, minutes and tenths of minutes. North latitudes and west longitudes are positive numbers, south latitudes and east longitudes are negative numbers.
	Do not use coordinates located at diametrically opposite sides of the earth. Do not use latitudes at $+90^{\circ}$ or $-90^{\circ}$ (i.e., North and South Poles).
	This program may give flashing zeros when trying to compute

This program has been verified only with respect to the numerical example given in *Program Description II*. User accepts and uses this program material AT HIS OWN RISK, in reliance solely upon his own inspection of the program material and without reliance upon any representation or description concerning the program material.

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		•		
			•	
ample Problem(s)				
ind the great circle distance from St.	Helena to Be	rmuda.		
			anter mente alle e se mere par anteres da encompanyamente ante	
	LAT	LNG		
St. Helena	15° 55' S	5° 44'	W	
Bermuda	32° 19' N	64° 51'	W	
Solution(s)	ightly shorts	or than the	sum of the r	chumb
Solution(s) 1458.19 n.m. (note that this is only sl	ightly shorte	er than the	sum of the r	rhumb
Colution(s) 458.19 n.m. (note that this is only sl ines in Rhumb Line Navigation).	ightly shorte	er than the	e sum of the r	rhumb
Colution(s) 458.19 n.m. (note that this is only sl ines in Rhumb Line Navigation).	ightly shorte	er than the	e sum of the r See Display	rhumb
Folution(s) 458.19 n.m. (note that this is only sl ines in Rhumb Line Navigation). Reystrokes fl [Al 15.55 [CHS] [Al 5.44 [B] 32.19	ightly shorte	er than the	sum of the r See Display 4458.19	rhumb
Folution(s) 458.19 n.m. (note that this is only sl ines in Rhumb Line Navigation). Reystrokes f] [A] 15.55 [CHS] [A] 5.44 [B] 32.19 D]	ightly shorte [A] 64.51 [B]	er than the	sum of the r See Display 4458.19 311.12	rhumb
olution(s) 458.19 n.m. (note that this is only sl ines in Rhumb Line Navigation). eystrokes f] [A] 15.55 [CHS] [A] 5.44 [B] 32.19 D]	ightly shorte [A] 64.51 [B]	er than the	sum of the r See Display 4458.19 311.12	chumb
olution(s) 458.19 n.m. (note that this is only sl ines in Rhumb Line Navigation). eystrokes f] [A] 15.55 [CHS] [A] 5.44 [B] 32.19 D]	ightly shorte [A] 64.51 [B]	er than the	sum of the r See Display 4458.19 311.12	rhumb

This program is a direct translation of a program from the HP-65 Aviation Pac.



STEP	INSTRUCTIONS	INPUT DATA/UNITS	KEYS	OUTPUT DATA/UNITS
1.	Enter program			
2.	Initialize			
3.	Input source latitude*	DD.MMSS**		LAI <sub>S</sub> (deg)
	and source longitude	DDD.MMSS		$LNG_{S}(deg)$
4.	Input destination latitude	DDD, MMSS		IAT_(deg)
	and destination lognitude	DDD, MMSS		$LNG_{-}(deq)$
		0001111100		Dlacgy
5	Calculate leg distance			DIST(n.m.)
	and initial heading		D	HDG (deg)
6.	If next leg starts at last leg end			
	point go to step 4.			
7	To restart for an entirely new log go			
/.	to step 2			
+				
^	Positive numbers indicate north latitud	e		
	and west longitudes. Negative numbers			
	indicate south latitudes and east long-			
**	Itudes. DDD.MMSS means degrees decimal point			
	minutes and seconds 120 0713 is 120			
	degrees, 7 minutes and 13 seconds.			

			97	Program	Lis	sti	ng I		47
STEP K	EY ENTRY	KEY CODE		COMMENTS	STEP	KE	Y ENTRY	KEY CODE	COMMENTS
001	#LBLa	21 16 11				<b>0</b> 57	3	03	
<b>80</b> 2	CF2	16 22 <b>0</b> 2			1	<b>8</b> 58	6	<b>8</b> 6	
003	CLRG	16-53				059	0	00	
004	DEG	16-21				060	GSBC	23 13	
005	CLX	-51		1		<b>0</b> 61	R↓ EUTA	-31	
006	KIN	24				062	ENIT	-21	
<b>00</b> 7	TLULH UNCA	21 11				003 051	LU3 Drie	42 72 80	
000 000	DCI1	10 30 76 81				004 865	KULO Y	-75	
005 R1R	STO2	35 82				<b>8</b> 66		36 Ø7	
R11	XIY	-41				R67	XIY	-41	
012	ST01	35 01				068	-	-45	
013	RTN	24				069	X≠Y	-41	
014	<b>*</b> LBLB	21 12				070	SIN	41	
015	HMS→	16 36				071	÷	-24	
016	RCL3	36 <b>0</b> 3				072	RCL6	36 06	
017	ST04	35 04				073	÷	-24	
018	X≠Y	-41				074	COS⊣	16 42	
019	ST03	35 <b>0</b> 3				075	F2?	16 23 02	
020	RTN	24				076	-	-45	
821	*LBLC	21 13				077	RTN	24	_
022	RUL4	36 U4 36 D7				+			
023	KUL3	36 03			080	+			
024	-	-40							
020 020	ENIT	-21						<u> </u>	
020 027	51N 0	41						1	
027 828	¥\Y2	16-74							
820 829	SE2	16 21 <b>B</b> 2						1	
025 030	+	-55							1
<b>A</b> 31	CLX	-51							1
032	+	-55							
033	COS	42							
034	RCL2	36 82			090				
<b>8</b> 35	COS	42							
036	ST06	35 <b>0</b> 6							
037	X	-35							
<b>0</b> 38	RCL1	36 <b>0</b> 1							
<b>0</b> 39	COS	42							
040	X	-35							
041	RCL1	36 01	1			+			
042	51N	41				+			
043	5107	35 87			100				
044	RULZ	30 02				+		1	
04J 04 <i>c</i>	SIN STUG	75 AQ				1			
847	3700 X	-35				1			
<b>A4</b> 8	+	-55				1			
849	COS-	16 42				FL/	AGS	SET	STATUS
850	ENTT	-21			0			FLAGS	TRIG DISP
051	ENTT	-21			1			ON OFF	
<b>8</b> 52	6	06							
<b>0</b> 53	0	00			110				
854	х	-35			3			3 0 0	n_ <b>2</b>
<b>05</b> 5	RTN	24			J				
. 056	<b>≢LB</b> LD	21 14	L	REGIS	TERS				
0	11AT	2 1 A T	3 1	N/ 4LNG	5	6	ô	7	8 9

0	1LAT	$^{2}LAT$ $^{3}$	LNG	4 LNG \$	5	6 USED	<sup>7</sup> USEO	<sup>8</sup> USED	9
S0	S1	S2 S	63	S4	S5	S6	S7	S8	S9
A	В	4	С		D	E		I	

Program Title	Position Given	Heading, Speed, and Time	
Contributor's Name	Hewlett-Packard	4	
Address 1000	N.E. CIRCLE BIV	a	07000
City Corvari	13	State Oregon	Zip Code 97330
Program Description	1		
	Given the starting positi and the time of travel, calculated by a rhumbling	ion (LAT <sub>S</sub> , LNG <sub>S</sub> ), the heading, the speed the destination position (LAT <sub>D</sub> , LNG <sub>D</sub> ) is e.	
	$LAT_D = \left(\frac{Time \times S}{S}\right)$	$\left(\frac{1}{60}\right) + LAT_S$	
	$LNG_D = LNG_S$	$\frac{180}{\pi}  \left[ (\tan HDG) \times (\ln \tan(45 + \frac{1}{2} LAT_D) \right]$	
	– ln tan (4	45 + ½ LAT <sub>S</sub> ))]	
	If HDG = $90^{\circ}$ or 27	70° then	
	$LNG_{D} = \frac{DIST}{60 \cos LA}$	$\frac{1}{AT}$ + LNG <sub>S</sub>	
	HDG = Heading		
	Speed = Speed in ki	nots	
	Time = Time in hou	ITS	
	DIST = Speed × Tin	ne	
Operating Limits and	l Warnings		
	imits and Wards		
	The path of flight may not o	cross a pole.	

This program has been verified only with respect to the numerical example given in *Program Description II*. User accepts and uses this program material AT HIS OWN RISK, in reliance solely upon his own inspection of the program material and without reliance upon any representation or description concerning the program material.

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Sketch(es)			
	······································		
Sample Problem(s)			
(-)			
	Sample Problem		
	Starting at 30° N, 140° W, flying at 500 knots	with a heading of 237	
	degrees what is the position after two hours?		
Solution(s)			
30101011(3)	Solution		
	20° 55' N, 155° 30' W		
		×	
		See Displayed	
		155.30	
	30 A 140 A 237 B 500 C 2 D	20.55	
	D	20.00	
Reference (s)			
	This program is a direct translat	ion of a program from the HP-65	
	Aviation Pac.		
<u></u>			

	Position	Given Heading,	Speed and Time Time	7
LNG.	HDG	SPEED	→LNG <sub>D</sub> →LAT <sub>D</sub>	

STEP	INSTRUCTIONS	INPUT DATA/UNITS	KEYS	OUTPUT DATA/UNITS
1.	Enter program			
2.	Input latitude of starting point then	DD.MMSS	<b>A</b>	LATS
	longitude of starting point*	DDD.MMSS	A	LNGS
				_
3.	Input both of the followingstrue heading,	HDG(deg)	B	HDG
	speed	speed(knot	s) C	Speed
4.	Input time at speed and heading and			
	calculate final bngitude and	H.MMSS**		
	latitude (both in degrees, minutes, seconds)			D
	For not time to to shop A. for not booking			
5.	For new time go to step 4, for new heading			
	or speed go to step 3, for new starting			
	position go to step 2.			
	· · · · · · · · · · · · · · · · · · ·			
*	Southern latitudes and eastern longitudes are			
	expressed as negative values			
**	H.MMSS means hours, decimal point, minutes,			
	seconds. 2.0355 is 2 hours minutes and 55			
	seconds.			

		Ö	7 Pro	gram	Li	sti 1	ng I						4-
STEP K	EY ENTRY	KEY CODE	СОММЕ	INTS	STEP	KE	Y ENTRY	KE١	CODE		COM	MENTS	17
001	*LBLA	21 11	,,			<b>8</b> 57	+		-55				
002	HMS→	16 36				058	1		01				
003	RCL4	36 04				059	→R		44				
<i>6</i> 04	STO2	35 02				060	÷₽ ₽/		34 71				
005	XZY	-41				061	<i>K</i> ∳ 0707	7	-31				
<b>UU</b> 6	5104	35 04				062	5103	3.	003				
007	-KIN 	24				003 068	7NNƏ DTN	10	0 3J 2A				
008	FLDLD CTOS	21 12				004 025	+ 1 PI D	2	24 1 1 <i>1</i>				
007	DTN	33 83				00J 022	FLDLU Dri 1	2.	5 81				
010 Q11	+1 PI C	21 17				967 967	AHNS	1	6 75				
R12	STOR	35.06				<b>0</b> 68	RTN	-	24				
<b>A</b> 13	RTN	24				069	#LBLE	2	1 15				
014	*LBLD	21 14				070	2		02				
015	HMS→	16 36				071	÷		-24				
016	RCL6	36 86				<b>0</b> 72	4		84				
<b>01</b> 7	х	-35				073	5		<b>0</b> 5				
018	ST07	35 07				874	+		-55				
019	RCL5	36 05				075	TAN		43				
020	COS	42				076	LN		32				
021	x	-35				077	RTN		24				
822	6	06				+							
023	e	88			080	+							
024	÷	-24				+							
020	KLLZ	36 02				1							
020 027	t CTN	-55				1							
021 020	51N 61N-1	16 41											
020 Ø29	STR	75 01											
02J 030	ESBE	23 15											
<b>A</b> 31	RCL 2	36 82											
832	GSBE	23 15											
033	X=Y?	16-33						1					
034	GT01	22 01			090								
035	-	-45						ł					
036	RCL5	36 05											
<b>8</b> 37	TAN	43				+		+					
<b>0</b> 38	х	-35						+					
039	Pi	16-24						<u>+</u>					
040	÷	-24				+		<u> </u>					
041	1	<b>6</b> 1				1		1					
042	8	68											
043 BAA		-75			100								
047 045	£102	22 82											
R46	#IRI1	21 81											
047	RCL7	36 07											
048	RCL2	36 02				┼┲━	<b>FI 400</b>	<u> </u>		OFT O	TATUC		
049	COS	42				+b	FLAGS			SELS	TATUS		
<b>8</b> 58	÷	-24				ΗĽ		F	LAGS	TR	liG	DIS	SP
<b>0</b> 51	6	86				$+ ^1$					- Far	FIX	R
<b>Ø</b> 52	0	88				12		-1		GRA		SCI	
053	÷	-24			110	╧╋		2		RAD	<b>D</b>	ENĢ	
054	#LBL2	21 02				ΤĽ		3				n 🖌	<u> </u>
055	CHS	-22											
856	KUL4	35 84 -		REGIS	STERS					10		10	
0	LATO	2 LATS	3LNG	4 LNG S	<sup>5</sup> HDG	>	<sup>6</sup> SPIER	<b>ා</b> 7	DIST	8		19	
S0	S1	S2	S3	S4	S5		S6	S7		S8		S9	
Α		В	С		D			E			I		

Program Title Line	of Sight Distance		
Contributor's Name	lewlett-Packard		
Address 1000 N.E	. Circle Blvd.		
City Corvallis	State Oregon	Zip Code	97330
Program Description	This program calculates either the aircraft altitude or the line-of- sight distance from an aircraft to a transmitting station. The inputs are the transmitter height (MSL), terrain height (MSL), and either the line-of-sight distance (n.m.) or the aircraft altitude in feet above MSL.		
	TERRAIN		
	If		
	$R_{p} = R + ALT$ $R_{g} = R + TER$ $R_{t} = R + XTMR$		
	where		
	R = earth's radius = 3440 n.m. ALT = aircraft altitude TER = terrain altitude XMTR = transmitter altitude		
Operating Limits and Wa	arnings		

This program has been verified only with respect to the numerical example given in *Program Description II*. User accepts and uses this program material AT HIS OWN RISK, in reliance solely upon his own inspection of the program material and without reliance upon any representation or description concerning the program material.

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Program Title		
Contributor's Name Address		
City	State	Zip Code
Program Description, Equations, Variables		
Since R <sub>g</sub> is perpendicular to th	e line-of-sight	
$DIST = \sqrt{R_p^2 - R_g^2} + and$	$\sqrt{R_t^2 - R_g^2}$	
$ALT = \sqrt{R_g^2} + (D - \sqrt{F})$	$R_t^2 - R_g^2)$	
	· · · · · · · · · · · · · · · · · · ·	

Operating Limits and Warnings Terrain input must not exceed either transmitter height or aircraft altitude. Any attempts to do so will result in an "error" display. This program does not account for refraction of radio waves. The terrain input yields a worst case answer. If the terrain is close to either the station or the aircraft, the program will calculate a shorter distance or higher altitude than is actually necessary.

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Sketch(es)         Sketch(es)         Sample Problem(s)         An omnidirectional antenna is 2000 feet high. The surrounding terrain is 1000         feet high. How high must you be to receive the transmission from a distance of 100 n.m?							
Solution(s) ALT = 4887.18 feet Keystrokes See Display [f] [A] 1000 [A] 2000 [B] 100 [D] [f] [C] 4887.18							
Reference(s) This program is a direct translation of a program from the HP-65 <u>Aviation Pac</u> .							



STEP	INSTRUCTIONS	INPUT DATA/UNITS	KEYS		OUTPUT DATA/UNITS	
1.	Enter program				]	
					]	
2.	Initialize			A	]	1.00
					]	
3.	Input the following:				]	
	height of terrain between aircraft and transmitter	TER(feet)	A		]	TER
	and transmitter height	XMTR(feet)	B			XMTR
	and either airplane altitude	ALT(feet)	L C			R <sub>p</sub> <sup>2</sup> (feet <sup>2</sup> )
	or line of sight distance	DIST(n.m.)			]	DIST(feet)
4.	Calculate either aircraft altitude		f	C	]	ALT (feet)
	or line of sight distance		f	D	)	DIST(n.m.)
	-				]	
5.	To change inputs go to step 3 and change					
	desired values. For a new case go to step 2.					
					]	
					]	
				L		
					]	
					]	
					]	
					]	
				[	]	
					]	
					]	
					]	
					]	
					]	
					]	
					]	

#### 22

#### 97 Program Listing I

STEP	KEY ENTRY	1	KEY CODE	СОММ	ENTS	STEP	KE	Y ENTRY	ĸ	EY CODE	COMN	IENTS
00	t <b>≭</b> LBLa	21	16 11			I	<b>05</b> 7	RCL4		36 04		
00	2 CLRG		16-53				058	RCL8		36 08		
00	36		<b>8</b> 6	4			059	-		-45		
<b>00</b> 4	1 8		00				060			54 76 07		
00	57		07				061	RULS		30 03		
00	5 6		06				002	RULS		30 08		
00	7 ST06		35 06				003 GCA	- rv		-4J 54		
663	5 5		03				865	¥0 +		-55		
00	9 4 D 4		04	1			<b>A</b> 66	RCIG		36 86		
010	9 4 1 D		04	1			067	÷		-24		
01. Q1'	ι υ Σ γ		-75				068	RTN		24		
Q1	5 ST07		35 AZ	1			1		1	- 1		
R14	1 1		R1			070						
01	5 RTN		24									
01	5 ¥LBLA		21 11									
01	7 ST01		35 01									
01	B RCL7		36 07									
01	9 +		-55	ł								
821	9 X2		53	4								
02.	1 ST08		35 08									
02	2 RCL1		36 01	1								
023	3 RIN		24	1		080	-					
624	4 <b>#LBLB</b>		21 12	1					+			
023			35 02	1								
020 021	5 KULA 7 -		30 07									
92	r 7 R X2		-53									
82	9 STN4		35 84	]								
03	9 RCL2		36 02									
03	RTN		24	]								
03	2 <b>*LBLC</b>		21 13									
<b>83</b>	3 RCL7		36 07	4								
034	<b>f</b> +		-55	4		090			+			
03	5 X2		53	4					+			
03	5 ST03		35 03	4					+			
837	7 RTN		24	•					+			
83	B <b>*LBL</b> C	21	16 13						+			
032	KUL4		36 04						+			
04( DA	S KLLO		30 00 -45	1					1			
04: 04:	, IX		-40 -	İ								
R4:	RCI5		36 05									
84	4 -		-45			100						
84	5 RCL8		36 08						_			
840	5 <b>5</b> X		54									
847	7 →P		34									
848	B RCL7		36 07 -				+r	FLAGS	<u>+</u>		SET STATUS	
04	-		-45				10				TRIC	
05	Ø RTN		24				┼┼			ON OFF		
05			21 14								DEG 🕑	FIX 🗳
052			JD 00 - 75	1			2		٦.			
000	, A L CTAS		-30			110	3				HAD 🗆	
85	T RTN		24				╷╷			s ப பீ		
A2	s #LBLa	21	16 14				1					
	1			12	REGIS	STERS		6			8	9
)	CI דו		XTmi	$\left( \int A(\tau + \rho)^2 \right)^2$	(xm 12+0)2	Drey	141	$^{\circ}$	6 1	20901441	TED_DT	,
60	S1		S2	S3	Š4	S5	~~/	S6		67	S8	S9
4		В		с		D			E		I	

Program T	tle Position and/or Navig	ation by Two VOR's	
Contributo	's Name Hewlett-Packard		
Address City	Corvallis	State Oregon	Zip Code 97330

Program Description, Equations, Variables This program finds the distance	e from one of two
VOR's to an aircraft and may be used to navigate between any tw	o points, provided
signals can be received from two VOR stations.	
N A VOR 1 HDG 12 DIST 12 N VOR 2 POSITION	
$DIST = \frac{DIST_{12} \sin(R_2 - HDG_{12})}{\sin(R_2 - R_1)}$	
where	
R <sub>1</sub> = Radial from VOR <sub>1</sub> R <sub>2</sub> = Radial from VOR <sub>2</sub> HDG <sub>12</sub> = Heading between VORs DIST <sub>12</sub> = Distance between VORs DIST = Distance from VOR <sub>1</sub> to aircraft	
Operating Limits and Warnings	
	5

This program has been verified only with respect to the numerical example given in *Program Description II*. User accepts and uses this program material AT HIS OWN RISK, in reliance solely upon his own inspection of the program material and without reliance upon any representation or description concerning the program material.

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Program Title	Navigation by Two VORs		
Contributor's Name			
Address			
City	State	Zip Code	
			_
Program Description, Equations, Variables	This program may be used to n provided signals can be received fro	avigate between any two points om two VOR stations.	
		VOR 1 HDG 12 DIST 12 N R1 VOR 2	
	DIST	N R2 CURRENT POSITION	
	$D_1 = \frac{\text{DIST}_{12} \sin \theta}{\sin(R)}$	$\frac{(R_2 - HDG_{12})}{(2 - R_1)}$	
	$\overrightarrow{\text{DIST}} = \overrightarrow{\text{D}}_1$	$+ \overrightarrow{\text{DIST}_{1D}}$	
	where		
Operating Limits and Warnings	DIST <sub>12</sub> = Distance between V HDG <sub>12</sub> = Heading between V $R_1$ = Radial from VOR <sub>1</sub> $R_2$ = Radial from VOR <sub>2</sub> $D_1$ = Distance from VOR <sub>1</sub> to $\overline{D}_1$ = Aircraft position vector DIST <sub>1D</sub> = Destination positio DIST = Required flight vector	VORs VORs aircraft with respect to VOR <sub>1</sub> on vector with respect to VOR <sub>1</sub>	
The VORs must not be in a straight line fro	DIST = Required flight vector	r to destination	

This program has been verified only with respect to the numerical example given in *Program Description II*. User accepts and uses this program material AT HIS OWN RISK, in reliance solely upon his own inspection of the program material and without reliance upon any representation or description concerning the program material.

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· · · · ·				
Sketch(es)				i i
	· · · · · · · · · · · · · · · · · · ·			
Semple Broblem(s)	unte Problem			
Sample Problem(s) /, Sai	npie Problem			
	$R_1 = 170 \text{ degrees}$			
	$R_2 = 240 \text{ degrees}$			
	$DIST_{12} = 27 \text{ n.m.}$			
	$HDG_{12} = 125 degrees$			
1171	nat is the distance from VOR	.1?		
Wi				
2	anul D. H			
~, S	ample Problem			
	$R_1 = 170 \text{ degrees}$			
	$R_2 = 250 \text{ degrees}$			
	$DIST_{12} = 13 \text{ n.m.}$			
	$HDG_{12} = 145 degrees$			
	$HDG_{1D} = 255 degrees$			
	$DIST_{1D} = 20 \text{ n.m.}$			
Fi	nd the heading and distance	to the destination.		
Solution(s)	. Solution			
	DIST = 26  n/m			
	<b>DIST -</b> 20 II.III.			
	2. Solution			
	HDG = 289			
	DIST = 23  n.m.			
Reference (s)				
	• ···	-		
This prog	ram is a direct tra	nslation of a pr	ogram from the HP-65	
Aviation	Pac.			1
	· · · · · · · · · · · · · · · · · · ·			

Sketch(es)		ar and a first free of the
Sample Problem(s)		
Solution(s) Keystrokes	See Dieplayed	
Solution(s) Keystrokes	See Displayed	
Solution(s) Keystrokes 1. [f] [A] 170 [A] 240 [A] 27 [B] 125 [C] [f] [C]	See Displayed	
Solution(s) Keystrokes 1. [f] [A] 170 [A] 240 [A] 27 [B] 125 [C] [f] [C]	See Displayed 26	
Solution(s) Keystrokes 1. [f] [A] 170 [A] 240 [A] 27 [B] 125 [C] [f] [C]	See Displayed 26	
Solution(s)       Keystrokes         1.       [f]       [A]       170       [A]       240       [A]       27       [B]       125       [C]       [f]       [C]         2       [f]       [A]       170       [A]       250       [A]       12       [P]       145       [C]       255       [D]	See Displayed 26	
<pre>Solution(s) Keystrokes 1. [f] [A] 170 [A] 240 [A] 27 [B] 125 [C] [f] [C] 2. [f] [A] 170 [A] 250 [A] 13 [B] 145 [C] 255 [D]</pre>	See Displayed 26	
<pre>Solution(s) Keystrokes 1. [f] [A] 170 [A] 240 [A] 27 [B] 125 [C] [f] [C] 2. [f] [A] 170 [A] 250 [A] 13 [B] 145 [C] 255 [D] 20 [D] [E]</pre>	See Displayed 26 289	
<pre>Solution(s) Keystrokes 1. [f] [A] 170 [A] 240 [A] 27 [B] 125 [C] [f] [C] 2. [f] [A] 170 [A] 250 [A] 13 [B] 145 [C] 255 [D] 20 [D] [E] </pre>	See Displayed 26 289	
<pre>Solution(s) Keystrokes 1. [f] [A] 170 [A] 240 [A] 27 [B] 125 [C] [f] [C] 2. [f] [A] 170 [A] 250 [A] 13 [B] 145 [C] 255 [D] 20 [D] [E] [E]</pre>	See Displayed 26 289 23	
<pre>Solution(s) Keystrokes 1. [f] [A] 170 [A] 240 [A] 27 [B] 125 [C] [f] [C] 2. [f] [A] 170 [A] 250 [A] 13 [B] 145 [C] 255 [D] 20 [D] [E] [E]</pre>	See Displayed 26 289 23	
<pre>Solution(s) Keystrokes 1. [f] [A] 170 [A] 240 [A] 27 [B] 125 [C] [f] [C] 2. [f] [A] 170 [A] 250 [A] 13 [B] 145 [C] 255 [D] 20 [D] [E] [E]</pre>	See Displayed 26 289 23	
<pre>Solution(s) Keystrokes 1. [f] [A] 170 [A] 240 [A] 27 [B] 125 [C] [f] [C] 2. [f] [A] 170 [A] 250 [A] 13 [B] 145 [C] 255 [D] 20 [D] [E] [E]</pre>	See Displayed 26 289 23	
<pre>Solution(s) Keystrokes 1. [f] [A] 170 [A] 240 [A] 27 [B] 125 [C] [f] [C] 2. [f] [A] 170 [A] 250 [A] 13 [B] 145 [C] 255 [D] 20 [D] [E] [E]</pre>	See Displayed 26 289 23	
<pre>Solution(s) Keystrokes 1. [f] [A] 170 [A] 240 [A] 27 [B] 125 [C] [f] [C] 2. [f] [A] 170 [A] 250 [A] 13 [B] 145 [C] 255 [D] 20 [D] [E] [E]</pre>	See Displayed 26 289 23	
<pre>Solution(s) Keystrokes 1. [f] [A] 170 [A] 240 [A] 27 [B] 125 [C] [f] [C] 2. [f] [A] 170 [A] 250 [A] 13 [B] 145 [C] 255 [D] 20 [D] [E] [E]</pre>	See Displayed 26 289 23	
<pre>Solution(s) Keystrokes 1. [f] [A] 170 [A] 240 [A] 27 [B] 125 [C] [f] [C] 2. [f] [A] 170 [A] 250 [A] 13 [B] 145 [C] 255 [D] 20 [D] [E] [E]</pre>	See Displayed 26 289 23	
Solution(s)       Keystrokes         1. [f] [A] 170 [A] 240 [A] 27 [B] 125 [C] [f] [C]         2. [f] [A] 170 [A] 250 [A] 13 [B] 145 [C] 255 [D]         20 [D] [E]         [E]	See Displayed 26 289 23	
Solution(s)       Keystrokes         1. [f] [A] 170 [A] 240 [A] 27 [B] 125 [C] [f] [C]         2. [f] [A] 170 [A] 250 [A] 13 [B] 145 [C] 255 [D]         20 [D] [E]         [E]	See Displayed 26 289 23	
Solution(s)       Keystrokes         1.       [f] [A] 170 [A] 240 [A] 27 [B] 125 [C] [f] [C]         2.       [f] [A] 170 [A] 250 [A] 13 [B] 145 [C] 255 [D]         20 [D] [E]       [E]         Reference(s)	See Displayed 26 289 23	
Solution(s)       Keystrokes         1.       [f] [A] 170 [A] 240 [A] 27 [B] 125 [C] [f] [C]         2.       [f] [A] 170 [A] 250 [A] 13 [B] 145 [C] 255 [D]         20 [D] [E]       [E]         Reference (s)	See Displayed 26 289 23	
Solution(s)       Keystrokes         1.       [f] [A] 170 [A] 240 [A] 27 [B] 125 [C] [f] [C]         2.       [f] [A] 170 [A] 250 [A] 13 [B] 145 [C] 255 [D]         20       [D] [E]         [E]	See Displayed 26 289 23	
Solution(s)       Keystrokes         1.       [f] [A] 170 [A] 240 [A] 27 [B] 125 [C] [f] [C]         2.       [f] [A] 170 [A] 250 [A] 13 [B] 145 [C] 255 [D]         20       [D] [E]         [E]	See Displayed 26 289 23	
Solution(s)       Keystrokes         1. [f] [A] 170 [A] 240 [A] 27 [B] 125 [C] [f] [C]         2. [f] [A] 170 [A] 250 [A] 13 [B] 145 [C] 255 [D]         20 [D] [E]         [E]	See Displayed 26 289 23	
Solution(s)       Keystrokes         1.       [f] [A] 170 [A] 240 [A] 27 [B] 125 [C] [f] [C]         2.       [f] [A] 170 [A] 250 [A] 13 [B] 145 [C] 255 [D]         20       [D] [E]         [E]	See Displayed 26 289 23	

	1 INT R <sub>1</sub> ,R <sub>2</sub>	DIST <sub>12</sub>	DIST <sup>HDG</sup> 12	HDG10DIST10	→HDG →DIST	
STEP	IN	ISTRUCTIONS		INPUT DATA/UNITS	KEYS	C DA
1.	Enter program					
2.	Initialize				f A	
2	Input all of the f	llowing				

STEP	INSTRUCTIONS	INPUT DATA/UNITS	KEYS	OUTPUT DATA/UNITS
1.	Enter program			
2.	Initialize		f A	
3.	Input all of the following:			
	Present position radial from	<sub>0</sub>		
	VOR	~1(DEG)	A	R
	Present position radial from VOR <sub>2</sub>	R <sub>2</sub> (DEG)		R <sub>2</sub>
	Distance between VORS	DIST 12	B	DIST 2
	Heading of VOR <sub>2</sub> from VOR <sub>1</sub>	HDG <sub>12</sub> (DEG)		HDG <sub>12</sub>
4.	Calculate distance from VOR <sub>1</sub> or continue			DISE
	inputs			
	Heading from VOR <sub>1</sub> to destination	HDG <sub>1D</sub> (DEG)		HDG
	Distance from VOR <sub>1</sub> to destination	DISTID		
				110.0
5.	Calculate magnetic heading			HDG
6.	Calculate distance to destination		E	DIST
	For new case return to steps 3 and 4 and			
	change appropriate inputs.			

#### 28

#### 97 Program Listing I

28 STEP	KE		KEY CODE		СОММЕ	ENTS	STEP	KE		KEY CODE	COM	AENTS
las:	701	+1 DI	21 16 11					057	ST07	35 07		
	101 AA2	¥LBLa DSPØ	-63 00					058	X≠Y	-41		
	702	CLX	-51					059	ST08	35 08		
Ĩ	904	RTN	24					060	9	09		
ĺ	905	*LBLA	21 11					061	0	00		
l	906	ST01	35 01					062	RCL5	36 <b>0</b> 5		
6	907	RTN	24					063	-	-45		
6	<b>90</b> 8	*LBLA	21 11					064	RCL6	36 06		
6	309	ST02	35 <b>0</b> 2					065	→R	44		
	910	RTN	24					<b>0</b> 66	ST+7	35-55 07		
6	911	*LBLB	21 12					067	X≠Y	-41		
e e e e e e e e e e e e e e e e e e e	912	ST03	35 <b>0</b> 3					068	ST+8	35-55 08		
l	913	RTN	24					069	RCL8	36 08		
	914	*LBLC	21 13					070	KUL7	36 87		
6	915	5104	35 84					071	75 040	-41		
	<i>116</i>	RIN	24					012	A+1 0	-41		
e	917 240	#LBLC	21 16 13					074 074	R	86		
	310	RULZ	30 02 75 04					Ø75	XŦŸ	-41		
	917 920	KUL4	-45					Ø76	-	-45		
,	920 921	STN	41					877	Ø	88		
Ĩ	722	RCI 3	36 83					078	X≠Ÿ	-41		
é	123	X	-35					079	X£Y?	16-35		
Ę	324	RCL2	36 02					080	GSBe	23 16 15		
E	325	RCL1	36 01					081	ST07	35 <b>0</b> 7		
6	326	-	-45					082	R∔	-31		
é	327	SIN	41					<b>0</b> 83	R↓	-31		
é	928	÷	-24					084	ST08	35 08		
E	329	ABS	16 31					085	RCL7	36 07		
(	930	RTN	24					086		24		
	331	<b>\$LBLD</b>	21 14					000	#LBLE	21 15		
	152	5105	35 85					000	RULO DTN	30 00 24		
e (	133 774		24					005 090	*i Rio	21 16 15		
	775	STOC	21 14 75 AG					A91	<i><b>FLULE</b></i>	A3		
	776	PTN	24					092	6	86		
Ĩ	137	<b><i>*LBLE</i></b>	21 15					093	0	00		
e	338	RCL3	36 03					<i>0</i> 94	+	-55		
é	939	RCL1	36 01					<i>09</i> 5	RTN	24	-	
6	940	RCL2	36 02									
e	341	-	-45								4	
e	342	SIN	41								4	
e	943	÷	-24				100				4	
e	144	RULZ	36 02					+			1	
e c	14J 242	KLL4	30 04								1	
6	140	SIN	-4J 41					+			1	
Ģ	148	31N X	-35					1			1	
Ē	949	ABS	16 31						FLAGS		SET STATUS	
e	950	2	82					Пo		FLAGS	TRIG	DISP
e	951	7	07					$\prod$		ON OFF		
e	952	θ	00					+ 15-				
E	753	RCL1	36 01				110	ᆊĹ				
6	154	-	-45					<del> </del>  3		3 0 0		n_ <b>Q_</b>
6	100 150	X∓Y ⇒D	-41									
<u>و</u>	J6	7K	44			REGI	STERS					
0		$^{1}R.$	$^{2}R_{2}$	3 DIS	<i>r</i>	4HDG	<sup>5</sup> HD6		6 DEST	7	8	9
50		S1	<u>\$2</u>		12	<u>12</u> S4	S5	U	S6	S7	S8	S9
50						<b>•</b> •						
A			в	С			D			E	I	

Program Title Position by One Vor	
Contributor's Name Hewlett-Packard Address 1000 N.E. Circle Blvd.	
City Corvallis	State Oregon Zip Code 97330
Program Description, Equations, Variables	This program computes the distance from a VOR station to an aircraft. The distance is found in a manner similar to the classical situation where one flies at right angles to the VOR radial and computes the time to the VOR from the time between bearings and the degrees of bearing change. This program offers a more complete solution in that it is unnecessary to fly at right angles to the VOR station and it includes the effect of winds.
	The distance from the VOR station to the airplane is given by $S = (GS \times \Delta t) \sin(C - R_1) $ (1)
	sin( $R_1 - R_2$ ) where $GS = ground speed of aircraft$ $\Delta t = time between readings = t_2 - t_1$ C = magnetic course of aircraft $R_1 = first radial to the VOR$ $R_2 = second radial to the VOR$ $t_1 = time of the first VOR radial intercept.$ $t_2 = time of the second VOR radial intercept.$
Operating Limits and Warnings	

This program has been verified only with respect to the numerical example given in *Program Description II*. User accepts and uses this program material AT HIS OWN RISK, in reliance solely upon his own inspection of the program material and without reliance upon any representation or description concerning the program material.

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Program Title	Position by O	ne VOR	
Contributor's Name	Hewlett-Pac	kard	
Address 1000	) N.E. Circle	Blvd.	
City Corvall	lis	State Oregon	<b>Zip Code</b> 973330
			)
Program Description,	, Equations, Varia	bles	
	Ground spee	d and course are found from the polar representatio	n:
		$\frac{\mathrm{GS}}{\mathrm{60}} \ \angle \ \mathrm{C} = \mathrm{TAS} \ \angle \ \mathrm{HDG} - \mathrm{W} \ \angle \ \mathrm{D-V} \tag{2}$	.)
	where Although the the wind vec D indicates t it is blowing t	V = magnetic variation TAS = true airspeed HDG = aircraft heading W = wind velocity D = wind direction (true) $\angle$ should be read as "at angle". e ground speed vector is the true airspeed vector <i>plu</i> tor, equation (2) is correct because the wind direction the direction the wind is coming from, not the direction toward.	s
Operating Limits and	Warnings		
Ove diff to sec	erall accuracy is ference in VOR re obtain accurate ond.	limited by VOR receiver resolution. The adings should be at least 5° and preferably 10° results. Times must be input to the nearest	

This program has been verified only with respect to the numerical example given in *Program Description II*. User accepts and uses this program material AT HIS OWN RISK, in reliance solely upon his own inspection of the program material and without reliance upon any representation or description concerning the program material.

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		• • • • • • • • • • • • • • • • • • • •
		· · · · · · · · · · · · · · · · · · ·
	• • • • • •	
Sample Problem(s)		
An airplane is flying at a heading of 35°. Its true airspeed	d is 150	
knots. The reported winds are 240° at 19 knots. Magnetic v is 15° west. At 3:22:10 the OMNI indicates a heading of 3:30	variation	
station. At 3:34:30 the VOR reads 240° to the station. Wh	at is the	
distance to the station at the time of the second reading?		
Solution(s) 31.72 nautical miles		
Solution(s) 31.72 nautical miles		
Solution(s) 31.72 nautical miles	See Displa	
Solution(s) 31.72 nautical miles Keystrokes	See Displa	<u>کې</u>
Solution(s) 31.72 nautical miles Keystrokes [f] [A] 240.19 [A] 15 [CHS] [A] 35 [B] 150 [B] 2 2010 [0] 220 [D] 2 2420 [0] 240 [D] [5]	See Displa	Ŋ
Solution(s)       31.72 nautical miles         Keystrokes       [f] [A] 240.19 [A] 15 [CHS] [A] 35 [B] 150 [B]         3.2210 [C] 330 [D] 3.3430 [C] 240 [D] [E]	See Displa 31.72	ι <b>γ</b>
Solution(s)       31.72 nautical miles         Keystrokes       [f] [A] 240.19 [A] 15 [CHS] [A] 35 [B] 150 [B]         3.2210 [C] 330 [D] 3.3430 [C] 240 [D] [E]	See Displa 31.72	Ŋ
Solution(s)       31.72 nautical miles         Keystrokes       [f] [A] 240.19 [A] 15 [CHS] [A] 35 [B] 150 [B]         3.2210 [C] 330 [D] 3.3430 [C] 240 [D] [E]	See Displa 31.72	ι <b>γ</b>
31.72 nautical miles         Keystrokes         [f] [A] 240.19 [A] 15 [CHS] [A] 35 [B] 150 [B]         3.2210 [C] 330 [D] 3.3430 [C] 240 [D] [E]	See Displa 31.72	Ŋ
Solution(s)       31.72 nautical miles         Keystrokes       [f] [A] 240.19 [A] 15 [CHS] [A] 35 [B] 150 [B]         3.2210 [C] 330 [D] 3.3430 [C] 240 [D] [E]	See Displa 31.72	ιy
Solution(s)       31.72 nautical miles         Keystrokes         [f] [A] 240.19 [A] 15 [CHS] [A] 35 [B] 150 [B]         3.2210 [C] 330 [D] 3.3430 [C] 240 [D] [E]	See Displa 31.72	١ <u>٧</u>
Solution(s)       31.72 nautical miles         Keystrokes       [f] [A] 240.19 [A] 15 [CHS] [A] 35 [B] 150 [B]         3.2210 [C] 330 [D] 3.3430 [C] 240 [D] [E]	See Displa 31.72	۷۷ ۱۷
31.72 nautical miles         Keystrokes         [f] [A] 240.19 [A] 15 [CHS] [A] 35 [B] 150 [B]         3.2210 [C] 330 [D] 3.3430 [C] 240 [D] [E]         Reference (s)	See Displa 31.72	₹ <u>₹</u>
Solution(s)         31.72 nautical miles           Keystrokes         [f] [A] 240.19 [A] 15 [CHS] [A] 35 [B] 150 [B]           3.2210 [C] 330 [D] 3.3430 [C] 240 [D] [E]             Reference(s)             This program is a direct translation of a program	See Displa 31.72	ΥΥ HP-65
Solution(s)       31.72 nautical miles         Keystrokes       [f] [A] 240.19 [A] 15 [CHS] [A] 35 [B] 150 [B]         3.2210 [C] 330 [D] 3.3430 [C] 240 [D] [E]         Reference(s)         This program is a direct translation of a prog         Aviation Pac.	See Displa 31.72	ΝΥ ΗΡ-65
Solution(s)       31.72 nautical miles         Keystrokes       [f] [A] 240.19 [A] 15 [CHS] [A] 35 [B] 150 [B]         3.2210 [C] 330 [D] 3.3430 [C] 240 [D] [E]         Reference(s)         This program is a direct translation of a prog         Aviation Pac.	See Displa 31.72	Αγ ΗΡ-65
Solution(s) 31.72 nautical miles Keystrokes [f] [A] 240.19 [A] 15 [CHS] [A] 35 [B] 150 [B] 3.2210 [C] 330 [D] 3.3430 [C] 240 [D] [E] Reference(s) This program is a direct translation of a prog <u>Aviation Pac</u> .	See Displa 31.72	ΝΥ ΗΡ-65



STEP	INSTRUCTIONS	INPUT DATA/UNITS	KEYS	OUTPUT DATA/UNITS
1.	Enter program			
2.	Initialize			0.00
3.	Optional: Input wind vector then	DDD.KK		DDD.KK
	magnetic variation (+E,-W)	V(Deg)		V
4.	Input all of the following:			
	Aircraft heading	HDG(Deg)	B	HDG
	then true airspeed	TAS(n.m.)	B	TAS
	Intersection time of first radial	t (H.MMSS)	* <u>C</u>	t
	first radial heading to the VOR	Rl(Deg)		R1
				to
5.	Input intersection time of second VOR radial	$t_2(H, MMSS)$		2
	and second radial heading to the VOR	R <sub>2</sub> (deg)		<sup>R</sup> 2
6.	Calculate distance to VOR			DIST(n.m.)
7.	For a second fix using the same station go			
	to step 5. For a new case go to step 3.			
*	H MMSS means hours, decimal point, minutes,			
	seconds 2 0355 is 2 hours 3 minutes and 55			
	seconds.			

675D 1		X								33
SIEP	CET ENIRT	KEY CODE	СОММ	ENTS	STEP	KE	Y ENTRY	KEY CODE	COMM	ENTS
601	<b>*LBL</b> a 21	16 11			1	057	HMS+	16-55		
002	CLX	-51			1	<b>85</b> 8	HMS÷	16 36		
<b>00</b> 3	ST01	35 01				<b>0</b> 59	ENTT	-21		
004	ST02	35 02				868	CLX	-51		
005	DEG	16-21			l	061	X>Y?	16-34		
886	RTN	24			[	062	GSBe	23 16 15		
887	≢I BLA	21 11			[	063	+	-55		
888	ST02	75 02				864	x	-35		
880	DTN	24				865	¥ <del>.</del>	-41		
003	+1 DI A	21 11				005	DCI7	76 97		
010	#LDLH CTO:	75 01			ł	000	RULI	30 UT		
611	5101	35 01			ł	00/	~~~	-40		
012	RIN	24			ł	068	51N	41		
013	*LBLB	21 12			ł	669	X	-35		
014	ST04	35 84			ł	070	RCL7	36 07		
015	RTN	24				071	RCL8	36 <b>0</b> 8		
016	<b>≭LBLB</b>	21 12			1	072	-	-45		
017	ST03	35 03			l	073	SIN	41		
018	RTN	24				074	÷	-24		
A19	<b>≭</b> LBLC	21 13			I	075	RTN	24		
828	RCL 6	36 86			1	076	#LBLe	21 16 15		
821	5105	35 85			t l	Ø77	CLX	-51		
822	¥+¥	-41			1	878	2	82		
022	CTOS	75 86			ł	870	4	84		
023	5106	33 86			ł	012	ד	24		
024	KIN	24			ł	000	KIN	24		
025	*LBLU	21 14							-	
<b>0</b> 26	RCL8	36 88							-	
027	ST07	35 07							-	
028	X≓Y	-41							-	
029	ST08	35 08							4	
830	RTN	24				_			4	
031	*LBLE	21 15								
032	RCL2	36 02								
833	INT	16 34								
834	RCI 1	36 01			090					
875	-	-45								
975	PCI 2	76 82							1	
030	EDC	15 44				+			-	
031	FRU	_27							4	
038	EEA	-23				+			-	
839	2	02							-1	
848	X	-35							-	
041	CHS	-22				+			-	
042	÷R	44				+			-	
043	RCL4	36 04							4	
044	RCL3	36 03			100				4	
045	÷₽	44							4	
846	X≠Y	-41							4	
847	RŤ	16-31								
848	+	-55								
849	R1	-31					FLAGS		SET STATUS	
075 050	+	-55				0		FLAGS	TRIG	DISP
050	₽+	16-31							<del>7</del>	
051	 V+V	-41				<b>†</b>  '			DEG 🕑	FIX 🗹
032	۱+۵ ⊄د	74				2		100	GRAD 🗆	SCI 🗆
003		34 76 86			110			<u> </u>	1 RAD	ENG
604	RULD	30 00				[]		3 🗆 🖸	1	n
855	KULJ	30 <b>0</b> 0								
056	CHS	-22 —		REGI	STERS	-				
0	1 14	2200 111	3	4 11 21	5		6	7	8	Э П
•	VQE6.	) NUUKK	TAS	HUG	T,		72	R.	K2	
S0	S1	S2	S3	S4	S5		S6	S7	S8 5	59
	-									
Δ	IB	<b>I</b>	lc		D			E	I	
			1-		1				1	

Program Title D	M E Speed Correction	
Contributor's Name Hew1 Address 1000 N.E.	ett-Packard Circle Blvd.	07000
City Corvallis	State Oregon Zip Co	de 9/330
Program Description, Equ	The program calculatesground speed from the DME speed indicator when the airplane course is not directly to or from a DME station.	
	The DME speed indicator reads the component of velocity that is on a line between the plane and the DME station. The component $V_1$ is given by:	
	$V_1 = GS \times  \cos (D - C) $	
	where	
	GS = The aircraft speed D = Direction to (or from) the DME station C = Aircraft ground course	
	solving for GS	
	$GS = \frac{V_1}{ \cos(D-C) }$	
	The program will also correct for aircraft altitude	
	$GS' = \frac{GS\sqrt{\Delta h^2 + DIST^2}}{DIST}$	
	where	
	GS' = Aircraft ground speed corrected for heading and elevation $\Delta h$ = Difference between aircraft and DME altitude. DIST = Distance to DME	
Operating Limits and Warning	Limits and Warnings	
	The accuracy of the DME and the limits of measuring D and C cause errors when angles to DME radials approach 90 degrees. To obtain accurate values, you should only use data obtained when crossing DME radials at an angle less than $60^{\circ}$ .	
	The program uses ground course as an input, not aircraft heading. Aircraft headings must be corrected by the wind correction angle to obtain ground course.	

This program has been verified only with respect to the numerical example given in *Program Description II*. User accepts and uses this program material AT HIS OWN RISK, in reliance solely upon his own inspection of the program material and without reliance upon any representation or description concerning the program material.

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Sketch(es)								
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	 nana ing sa	• • • • • • • • • • • • • • • • • • •	анын тараан Колон Кол Колон Колон Кол Колон Колон Кол	· • · · ·		aa		******
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	 non composition and a second s							
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							; • • • • • • • • • •	

Sample Problem(s) An airplane flying a course of 265° interce	ents the 220° TO radial of a DME station
The indicated DME speed is 123 knots. What	is the ground speed.
If you are 10,000 feet above the DME static	on and 7 n.m. away what is your ground
speed?	
GS = 1/4 knots	
GS'= 179 knots	
Keystrokes	See Display
[f] [A] 265 [A] 220 [B] 123 [C]	174
7 [D] 10000 [E]	179

#### Reference (s)

This program is a direct translation of a program from the HP-65 Aviation Pac.

↓1 INT Course	_ Radial _	DME SPD → GS - DIST	∆ h – →GS	2
Course	Radial	→ GS DIST	→GS	

STEP	INSTRUCTIONS	INPUT DATA/UNITS	KEYS	OUTPUT DATA/UNITS
1.	Enter program			
2.	Initialize		f A	
3.	Input course (degrees)	course		course
	and radial (degrees)	radial		radial
4.	Input DME speed and calculate ground speed	Vj(knots)		GS(knots)
5.	Optional:* Input distance to DME	DIST(n.m.)		DIST
	Input altitude above DME and calculate GS	$\Delta h(ft)$		GS(knots)
6.	For new case with same course and radial go to			
	step 4. Go to step 3 for new case.			
+	Stop E composts for alcustion officity and is			
	Step 5 corrects for elevation effects and is			
	not necessary unless the aircraft is very high			
	or very close to the DME station.			

#### 97 Program Listing I

STEP I		KEY CODE	7/	сомм	ENTS	STEP	KEY ENTRY	KEY CODE	COM	MENTS
001	#LBLa	21 16 11								
882	DSP0	-63 00							]	
003	CLX	-51				000			4	
<del>00</del> 4	RTN	24				060			4	
885	*LBLA	21 11							4	
006	ST01	35 01							4	
007	RTN	24							4	
<b>00</b> 8	<b>≭LB</b> LB	21 12							4	
009	STO2	35 <b>0</b> 2							4	
010	RTN	24						+	4	
011	<b>≢LB</b> LC	21 13							4	
012	RCL2	36 02							4	
013	RCL1	36 01				070			4	
014	-	-45				0/0		+	4	
015	COS	42							4	
016	÷	-24						+	4	
017	ABS	16 31							4	
018	ST03	35 03						+	4	
019	RTN	24							4	
020	*LBLD	21 14							1	
021	S104	35 04	1						1	
022	RIN	24						1	1	
023	<b>#LBLE</b>	21 15	1			080			1	
024	ENIT	-21	1						1	
020	6	<b>8</b> 6	1						1	
020		<b>U</b> U 07	1						1	
027	<i>(</i>	<b>U</b> (	1						1	
020	-	00	1 .						1	
023	- vo	-24	1						1	
030 071	DCI A	J3 76 94	1						]	
031	KUL4 V2	30 <del>04</del> 57							]	
932		-55								
033 074		50 54	]			090				
034 075	PCI 4	36 <b>R</b> 4								
A36	÷	-24								
<b>A</b> 37	RCL 3	36 83							4	
038	x	-35							4	
039	RTN	24	4						4	
F								<b> </b>	4	
									4	
									4	
						100			4	
<u> </u>						100			4	
<u> </u>								<u> </u>	1	
								+	1	
									1	
			_				FLAGS		SET STATUS	
050							0	FLAGS	TRIG	DISP
							1	ON OFF	1	X X
								0 0 0/	DEG 🗗	FIX D
							2 <sup>2</sup>			
			_			110	- 3			
L							↓┘		L	
					DEAN					
	1	2 -17	12		HEGI	5	6	7	8	9
U	Cono	SE PANT	ac l	65	DIST	ľ	ľ			
SO	SI	S2	S3	¥ -	S4	S5	S6	S7	S8	S9
A		В		С		D		E	I	
1		1				I				

Program Title Average Wind Vector	
Contributor's Name Hewlett-Packard	
Address 1000 N.E. Circle Blvd.	
City Corvallis	State Oregon Zip Code 97330
Program Description, Equations, Variables	
	When planning a flight it may be helpful to reduce several reported wind vectors along the flight path to one average wind. By weighting each wind vector along the flight path according to the distance it acts, an approximate average wind vector can be found. For a flight from A to D with forecast winds as shown:
	A
	WIND AR T WINDBC
	WIND CD D
	$\overrightarrow{\text{Wind Ave}} = \frac{1}{\text{Dist}_{AD}} \left[ (\text{Dist}_{AB}) (\overrightarrow{\text{Wind}}_{AB}) + (\text{Dist}_{BC}) \right]$
	$(\overline{Wind}_{BC}) + (Dist_{CD})(\overline{Wind}_{CD})$
Operating Limits and Warnings	
Limits and Warnings	
The greater the aircraft vel closer the approximation is	ocity as compared to that of the wind, the
The velocity of input winds	s must be less than 100.
This program has been verified only with respect to	the numerical example given in Program Description II. User accents and uses

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Sketch(es)	
Sample Problem(s)	
Sample Problem	
	n the following wind
pattern along his flight path. what is the approx	ximate average wind?
160° 135°	
10 KNOTS 40 KNOT	20 NM D
220° 15 KNOTS	
B 45 NW	
30 NM	
P	
Solution(s) Solution	
$\frac{1}{2}$	
while Ave = 102.15 of a 15 knot wind at 162	degrees
Keystrokes	See Displayed
[f][A] 220.15 A 30 B 160.10 A 45 B	
135.40 А 20 В С	162.15
(	
Reference (s)	
This are a second secon	
Inis program is a direct transla Aviation Pac	ition of a program from the HP-65
<u>Avración rac</u> .	



STEP	INSTRUCTIONS	INPUT DATA/UNITS	KEYS	OUTPUT DATA/UNITS
1.	Enter program			
2.	Initialize			0.00
3	Input wind vector for a particular flight			
	segment and input distance along segment	DDD, KK*		DDD.KK
	over which wind vector acts	DIST	B	DIST
4.	Repeat step 3 for each segment			
5.	Calculate average wind			DDD.KK
6	For new case do to step 2			
0.				
*	DDD.KK means direction, decimal point, wind			
	speed. 325.08 means a direction of 325			
	degrees and a speed of 8 knots.			

			97	Program	LĬS	<b>SU</b>	ng I				41
STEP	KEY ENTRY	KEY CODE		COMMENTS	STEP	KE	Y ENTRY		KEY CODE	COMI	MENTS
08	1 ¥LBLa	21 16 11									
08	2 DSP2	-63 02						+		4	
00	13 CLRG	16-53			060			+		1	
08	14 CLX	-51						╋		1	
66		24						+		1	
00	10 ¥LBLH 17 CTO7	21 11 75 87								1	
00	NA ENTA	-21								1	
	19 ERC	16 44								]	
A1	<b>A</b> ST02	35 02								]	
01	1 -	-45									
01	2 ST03	35 03						_		1	
01	3 RCL7	36 07						-		4	
01	4 RTN	24			070			+		4	
01	5 ¥LBLB	21 12						+		4	
01	6 ST07	35 07						+		ł	
01	7 ST+1	35-55 01						+		-	
01	8 RCL2	36 <b>0</b> 2						+		ł	
01	9 x	-35						+		1	
02	O RCL3	36 83						+		1	
02	(1 XZY	-41								1	
02	2 7K 77 стіл	44 75_55 QA									
02	3 3174 M V+V	- <b>4</b> 1			080						
82	.+ ∩+1 95 ST+5	75-55 AS									
82	6 RCL7	36 07									
82	7 RTN	24				L					
02	8 #LBLC	21 13				ļ					
82	9 RCL5	36 05				<b> </b>		_		4	
03	Ø RCL1	36 01						+		4	
83	11 ÷	-24						+		ł	
03	2 RCL4	36 04						+-		4	
03	3 RCL1	36 01			090			+		1	
03	4 ÷	-24						+		1	
03	15 <del>- 7</del> - 7	34				t				1	
83	15 SIUB	33 86								1	
03 07	07 K+ 10 CTN7	-31 75 07								1	
03 03		-21									
A4		-51									
84	1 X>Y?	16-34				L		_		1	
84	2 GSBc	23 16 13				<b> </b>		+		4	
84	3 +	-55			100			+		4	
04	4.	-62			100	<u> </u>				4	
04	5 5	05						+		4	
04	6 +	-55				<u> </u>		+		1	
04	7 INT	16 34						+		1	
04	18 RCL6	36 06					FLAGS			SET STATUS	
84	19 + 10 рти	-33				0			FLAGS	TRIG	DISP
00 85	HORIN 1. #IRIA	21 16 13						-	ON OFF		1
03 05		-51							•	DEG	
A5	3 3	03			110	$H^2$					
05	i4 6	06			110	-3			$3 \square \mathbf{E}$		n <u>2</u>
05	i5 0	00				┼┸━╸				L	
05	6 RTN	24	L	REGI	STERS	<b>.</b>					
)	Sim	$D^2 V/m$	3	NIND° <sup>4</sup> E	<sup>5</sup> E,	,	6 Nue 1/	00	T USED	8	9
30	S1	S2	S3	S4	S5		S6		S7	S8	S9
4		В		С	D			Е		I	

Program Title	Course Correction		
Contributor's Name Address 1000 City Corval 1	Hewlett-Packard N.E. Circle Blvd. is	State Oregon	Zip Code 97330
Program Description	n, Equations, Variables The progr to destina course.	ram calculates the new corrected heating for an aircraft which has strayed $h_{H_{H_{h_{h_{h_{h_{h_{h_{h_{h_{h_{h_{h_{h_{h_$	ading and the distance d a known distance off
Operating Limits and	d Warnings		

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Program Title		
Contributor's Name		
Address City	State	Zip Code

The f	ollowing inputs are used in calculations.	
DC	DC = Distance off course (this is input as a positive quantity if you are left of course and as a negative quantity if you are to the right of course);	
T DIS	ST = Total distance from the point of origin to the point of destination;	
DT(	CP = Distance to checkpoint from point of origin;	
D FLN =	Distance actually flown from origin to point of course correction calculation. This value may be used instead of DTCP. When it is used it is input as a negative quantity;	
H INI =	The initial heading that should have been flown to arrive at the point of destination;	
H FLN =	The heading actually flown to arrive at the point of	
The output	uts of calculation are:	
HDG =	The new heading to be flown to arrive at the point of destination;	
ing Limits and Warnings		

This program has been verified only with respect to the numerical example given in *Program Description II*. User accepts and uses this program material AT HIS OWN RISK, in reliance solely upon his own inspection of the program material and without reliance upon any representation or description concerning the program material.

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Program Title		
Contributor's Name		
Address		
City	State	Zip Code
		)
Program Description, Equ	uations, Variables	
DT	G = The distance to go from the point of calculation;	
	$DTCP = \sqrt{(-DF)^2 - (DOC)^2}$	
	$DTG = \sqrt{(DTCP - T DIST)^2 + (DOC)^2}$	
	$HDG = \sin^{-1} \left( \frac{DOC}{DTG} \right) + H INI$	
Uperating Limits and Wai	rnings	
Limits ar	nd Warnings	
This pro	gram assumes a flat earth. Large distances or calculatio	
near the	poles will yield inaccurate results.	

This program has been verified only with respect to the numerical example given in *Program Description II*. User accepts and uses this program material AT HIS OWN RISK, in reliance solely upon his own inspection of the program material and without reliance upon any representation or description concerning the program material.

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(Ferrit		· · · · · ·	
Sketch(es)			
Sample Problem(s)			
	Sample Problem		
	Suppose		
	DOC = 15.6 (left)	·	
	DOC = 13.0 (left) T DICT = 190		
	1  DISI = 180		
	H INI = 85.5  degrees		
	D FLN = 104 (input as $-104$ )		
	Find the heading which must be flown to reach the	destination and	
	the distance to destinction	destination and	
	the distance to destination.		
Solution(s)			
	Solution		(1) B. W. C. BRAN, A. M. C. MARK, M. M. M. MARK, M. C. M.
	Solution		-
	HDG = 96.93 degrees		
	DTG = 78.74 miles	-	
		-	
	Course Correction		
	Keystrokes	Car Dis t	
		See Displayed	
	LIJLAJ 15.6 A 180 B 85.5 D 104 CHS C E	96.93	
	E	78 74 -	
		10.14	
Reference (s)			
nelelelice (3)			
This pro	ogram is a direct translation of a prog	ram from the HP-65	, )
Aviation	Pac.		
1.			



1. Enter program	STEP	INSTRUCTIONS	INPUT DATA/UNITS	KEYS	OUTPUT DATA/UNITS
2.       Initialize	1.	Enter program			
2.       Initialize       f       A       0.00         3.       Input distance off course (+left or -right) and total distance       DOC       A       DOC         and total distance from origin to checkpoint or distance flown (negative)       -D FLN       C       DTCP         and initial heading or heading flown (negative)       -D FLN       C       D C+H FLN(Deg)         4.       Calculate new heading       E       HOG (Deg)         5.       Calculate distance to destination (Steps 4 and 5 may be repeated alternately to display HDG and DTG)       E       DTG         6.       To modify problem go to step 3. For new case go to step 2.       Image: Comparison of the comparison of th					
and total distance off course (+left or -right)       DOC       A       DOC         and total distance from origin to checkpoint       DITP       C       DTCP         or distance from (negative)       -D FLN       C       -D FLN         and initial heading       H INI(Deg)       D       H INI (Deg)         or distance flown (negative)       -H FLN(Deg)       D       -H FLN(Deg)         4. Calculate new heading       E       HDG (Deg)         5. Calculate distance to destination       E       DTG         (Steps 4 and 5 may be repeated alternately to       D       D         display HDG and DTG)       D       D       D         6. To modify problem go to step 3. For new case       D       D       D         go to step 2.       D       D       D       D         Image: Complex compl	2.	Initialize		f A	0.00
3. Input distance off course (±left or -right)       DOC       A       DOC         and total distance       T DIST       B       T DIST       B       T DIST         and distance from origin to checkpoint       DTCP       C       DTCP       -D FLN         or distance flown (negative)       -D FLN       C       DTCP       -D FLN         and initial heading       H INI(Deg)       D       -H FLN(Deg)       D       -H FLN(Deg)         4. Calculate new heading       E       DTG       DTG       -D FLN         5. Calculate distance to destination       E       DTG       DTG       -D FLN         display HDG and DTG)		1			0.00
3. Input distance off course (+left or -right)       DOC       IA       I       DOL         and total distance       TDIST       I       I       DTCP         or distance from origin to checkpoint       DTCP       C       -D FLN       C       -D FLN         and initial heading       H INI(Deg)       D       H HNI (Deg)       D       H HNI (Deg)         or heading flown (negative)       -H FLN(Deg)       D       H HNI (Deg)       D       H HNI (Deg)         4. Calculate new heading       I       III (Deg)       D       III (Deg)       D       III (Deg)         5. Calculate distance to destination       I       III (Deg)       DTG       III (Deg)       III (Deg)         6. To modify problem go to step 3. For new case       III (Deg)       III (Deg)       III (Deg)       III (Deg)         9       to step 2.       III (Deg)       III (Deg)       III (Deg)       IIII (Deg)         1       III (Deg)       III (Deg)       III (Deg)       III (Deg)       III (Deg)       III (Deg)         5. Calculate distance to destination       III (Deg)       IIII (Deg)       IIII (Deg)       IIII (Deg)       IIII (Deg)         6. To modify problem go to step 3. For new case       IIIIII (Deg)       IIIII (Deg)       II					DOC
and total distance       1 DISI       1 B       1 DISI       1 B       1 DISI         and distance from origin to checkpoint       DTCP       C       DTCP       0       0       H INI(Deg)       D       H INI (Deg)       D       D       D       D       D       D       D       D       D       D       D       D       D       D       D       D       D       D       D       D       D       D       D       D       D       D       D       D       D <td< td=""><td>_3.</td><td>Input distance off course (+left or -right)</td><td></td><td></td><td></td></td<>	_3.	Input distance off course (+left or -right)			
and distance from origin to checkpoint       DTCP       C       -D FLN         or distance flown (negative)       -D FLN       C       -D FLN         and initial heading       H INI(Deg)       D       H INI (Deg)         or heading flown (negative)       -H FLN(Deg)       D       -H FLN(Deg)         4. Calculate new heading       E       HDG (Deg)         5. Calculate distance to destination       E       DTG         (Steps 4 and 5 may be repeated alternately to       DTG       DTG         (Steps 4 and 5 may be repeated alternately to       DTG       DTG         6. To modify problem go to step 3. For new case       DTG       DTG         go to step 2.       D       DTG       DTG         2       D       DTG       DTG       DTG         3       DTG       DTG       DTG       DTG         4       DTG and DTG)       DTG       DTG       DTG         4       DTG and DTG       DTG       DTG       DTG         5       To modify problem go to step 3. For new case       DTG       DTG       DTG         2       DTG       DTG       DTG       DTG       DTG         3       DTG       DTG       DTG       DTG		and total distance	I DISI		
and initial heading       -U FLN       -U FLN       -U FLN         and initial heading       H INI(Deg)       D       +H FLN(Deg)         4. Calculate new heading       E       HDG (Deg)         5. Calculate distance to destination       E       DTG         (Steps 4 and 5 may be repeated alternately to       D       -U FLN         display HDG and DTG)       DTG       DTG         6. To modify problem go to step 3. For new case       D       -         go to step 2.       D       -       -         2       -       -       -         3. To modify problem go to step 3. For new case       -       -         go to step 2.       -       -       -         2       -       -       -         3. To modify problem go to step 3. For new case       -       -         go to step 2.       -       -       -         4. Step 2.       -       -       -         5. To modify problem go to step 3. For new case       -       -         9. To step 2.       -       -       -         1. Step 3. For new case       -       -       -         2. Step 3. For new case       -       -       -         3.		and distance from origin to checkpoint			
and initial heading       H INI(Deg)       D       H INI(Deg)         or heading flown (negative)       -H FLN(Deg)       D       -H FLN(Deg)         4. Calculate new heading       E       HDG (Deg)         5. Calculate distance to destination       E       DTG         (Steps 4 and 5 may be repeated alternately to       E       DTG         display HDG and DTG)       E       DTG         6. To modify problem go to step 3. For new case       E       E         go to step 2.       E       E       E         2       E       E       E         3       E       E       E         4       E       E       E       E         9       to step 2.       E       E       E         2       E       E       E       E       E         2       E       E       E       E       E       E         3       E       E       E       E       E       E       E         4       E       E       E       E       E       E       E       E         2       E       E       E       E       E       E       E       E <td< td=""><td></td><td>or distance flown (negative)</td><td>-D FLN</td><td></td><td></td></td<>		or distance flown (negative)	-D FLN		
or heading flown (negative)       -H FLN(Deg)       D       -H FLN(Deg)         4. Calculate new heading       E       HDG (Deg)         5. Calculate distance to destination       E       DTG         (Steps 4 and 5 may be repeated alternately to       D       D       DTG         display HDG and DTG)       D       DTG       DTG         6. To modify problem go to step 3. For new case       D       D       D         go to step 2.       D       D       D       D         2       D       D       D       D       D         3       D       D       D       D       D       D         4       D       D       D       D       D       D       D         1       D       D       D       D       D       D       D       D       D       D       D       D       D       D       D       D       D       D       D       D       D       D       D       D       D       D       D       D       D       D       D       D       D       D       D       D       D       D       D       D       D       D       D       D       D </td <td></td> <td>and initial heading</td> <td>H INI(Deg</td> <td></td> <td>H INI (Deg)</td>		and initial heading	H INI(Deg		H INI (Deg)
4. Calculate new heading       E       HDG (Deg)         5. Calculate distance to destination       E       DTG         (Steps 4 and 5 may be repeated alternately to       Image: Colored step 2 and 5 may be repeated alternately to       Image: Colored step 2 and 5 may be repeated alternately to       Image: Colored step 2 and 5 may be repeated alternately to         6. To modify problem go to step 3. For new case       Image: Colored step 2 and 5 may be repeated step 2		or heading flown (negative)	-H FLN(Deg		-H FLN(Deg)
S. Calculate distance to destination (Steps 4 and 5 may be repeated alternately to display HDG and DTG)       Image: Comparison of the second of	4.	Calculate new heading			HDG (Deg)
5.       Calculate distance to destination (Steps 4 and 5 may be repeated alternately to display HDG and DTG)       Image: Construction of the step o					
(Steps 4 and 5 may be repeated alternately to display HDG and DTG)	5.	Calculate distance to destination		E	DTG
display HDG and DTG)		(Steps 4 and 5 may be repeated alternately to			
6. To modify problem go to step 3. For new case		display HDG and DTG)			
6. To modify problem go to step 3. For new case					
go to step 2.	6.	To modify problem go to step 3. For new case			
		go to step 2.			

			97 ľ	rogram	Li	sti	ng I				43
STEP K		KEY CODE	C	OMMENTS	STEP	KE	Y ENTRY	KEY CODE		COMME	ENTS
001	#LBLa	21 16 11				057	ST08	35 08	•		
002 887	CLK6	16-33				058	3	<b>0</b> 3			
804	RTN	24				039 020	6 6	<b>U</b> 6 00			
885	*LBLA	21 11			[	000 A61	X2Y?	16-35			
<b>88</b> 6	ST01	35 01			[	862	GSBe	23 16 15			
<b>00</b> 7	RTN	24				863	0	00			
008	*LBLB	21 12				064	RCL8	36 <b>8</b> 8			
009	ST04	35 04				<b>06</b> 5	X≟Y?	16-35			
010	RIN	24				<b>86</b> 6	GSBd	23 16 14			
011	FLBLU CTO2	21 13				067	0	00			
01Z 017	PTN	33 82 24				068	+ 00700	-55			
B14	#IRID	21 14				003 070	5108 DTN	33 UB 24			
015	ST03	35 03				971	#IRIF	21 15			
016	RTN	24				872	RCL6	36 86			
017	<b>*LBLE</b>	21 15				073	RTN	24			
018	RCL2	36 <b>0</b> 2				074	<i><b>*LBLe</b></i>	21 16 15			
019	0	00				075	-	-45			
020	XZY?	16-35				076	ST08	35 <b>0</b> 8			
821	6103	22 03				077	RTN	24			
022 927	KULZ V2	30 02				078	*LBLd	21 16 14			
023 024	RCII	36 Ø1				079 000	5	<b>U</b> 3			
R25	X2	53				080 001	0	86 88			
026	-	-45				001 082	+	-55			
027	<b>1</b> X	54				083	RTN	24			
<b>0</b> 28	ENTT	-21				<u> </u>		L			
<b>0</b> 29	<b>≭LBL</b> 3	21 03									
030	R↓	-31									
031	ST05	35 05									
032	RUL4	36 U4									
033 874	- ¥2	-40			090	+					
835	RCII	36 81							_		
836	X2	53									
837	+	-55									
<b>8</b> 38	1X	54									
039	ST06	35 <b>0</b> 6									
040	RCL1	36 01									
041	X₽Y	-41							_		
042	÷	-24									
043 044	51N" 6T07	10 41 75 07			100			1	-		
044 045	Priz	36 07									
R46	X>07	16-44									
847	GT01	22 01									
048	CHS	-22				┤┲─	51.4.00	1		ATUC	
849	RCL1	36 01					FLAGS		5EI 51	AIUS	
050	RCL5	36 05				┼╏		FLAGS	TRIC	<u> </u>	DISP
051	÷	-24				$+1^{1}$			DEG		FIX
052		16 43				2			GRAD		SCI
033 051	+ ∎IRI1	-JJ 21 A1			110	3		2 []	RAD		
855	RCL7	36 07						3 🗆 🗹	5		···
<b>0</b> 56	+	-55									
0	1000	2-0 FW	V 3-H F		5	<u>ر</u>		7	8		)
S0	S1	S2	<mark>р од Н</mark> 53	SA SA	S5	- 12	S6	S7	S8		69
					0				I		
A		D			5				l*		

#### Dradram Decerintian

ntributor's Name	Hewlett-Packard	
y Corvallis	State Oregon	Zip Code 97330
ogram Description, Eq	uations, Variables	
	Sunrise is computed from	
	$\mathbf{S} = [\theta_0 - \cos^{-1} (-\tan\phi_s  \tan\phi_0)]/15 - \mathbf{E} + 12$	2 (1)
	where	
	$\theta_0$ = observer's longitude $\phi_0$ = observer's latitude $\phi_s$ = subsolar latitude (declination of sun) E = equation of time	
	$\Phi_{s}$ and E are approximated by	
	$\begin{split} \varphi_{s} &\doteq -23.5 \cos (t + 10) \\ E &\doteq 0.123 \cos (t + 87) - \frac{1}{6} \sin (2t + 20) \\ t &\doteq 0.988 (D - 1 + 30.3 (m - 1)) \end{split}$	(2) (3) (9)
	where $D$ and $m$ are day and month respectively.	
	NOTE: Equation (1) computes the time at which the m sun is on the horizon. Equation (1) does not accoun pheric refractions. Refraction causes the sun to rise earl value given by equation (1).	iddle of the t for atmo- ier than the
perating Limits and Wa	rnings	

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Contributor's Name	
AddressState	Zip Code

Program Description,	Equations, Variables	
	Sunset is computed from	
	$S = [\theta_0 + \cos^{-1} (-\tan\phi_s \tan\phi_0)]/15 - E + 12 $ (1)	
	where:	
	$\theta_0$ = observer's longitude $\phi_0$ = observer's latitude $\phi_s$ = subsolar latitude (declination of sun) E = equation of time	
	$\phi_{s}$ and E are approximated by	
	$ \phi_{s} \doteq -23.5 \cos (t + 10) $ $ E \doteq 0.123 \cos (t + 87) - \frac{1}{6} \sin (2t + 20) $ $ t \doteq 0.988 (D - 1 + 30.3 (m - 1)) $	
	where D and m are day and month respectively.	
	NOTE: Equation (1) computes the time at which the middle of the sun is on the horizon. Equation (1) does not account for atmospheric refractions. Refraction causes the sun to set later than the value given by equation (1).	
Operating Limits and	Naminao	
	Limits and Warnings	
	The approximate values of $\phi_s$ and E cause s to exhibit a maximum error of + 4.7 minutes and -0.6 minutes at 45° north latitude, based on 1973 ephemeris data. Refraction and secular changes in the ephemeris can result in errors as large as +8 minutes from observed data at 45° north. Errors decrease as latitudes approach 0°. Large errors exist above 65°.	

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(		
Sketch(es)		
Sample Proble	9m(\$)	
	O	
	Sample Problems	(27° 27' N
	What time does the sun rise in San Francisco	(3/ 3/ N,
	122° 23' W) on Christmas Day? What time does the sun i	rise on June
	25?	
Berlin Arthouse		
-		
Solution(a)		
	Solutions	
	15:27 GMT (07:27 AM Pacific Standard Time)	
	12:53 GMT (05:53 AM Pacific Daylight Time)	
	Kevstrokes	See Displayed
	25 A 12 B 37.37 C 122.23 D	
	E	15.27
		12 53
	· U U	12.00
Reference (s)		
	This program is a direct translation of	f a program from the UP 65
	Aviation Pac.	· ~ P· ~ y· an · · On the HP-05

¶1 ₪ DA	MONTH	LAT	GMT LNG GMT	S SET S RISE

STEP	INSTRUCTIONS	INPUT DATA/UNITS	KEYS	OUTPUT DATA/UNITS
1.	Enter program			
2.	Enter all of the following:			
	Day of the month	Day		
	Month	Month	<b>B</b>	
	Observer Latitude **	DD.MMSS*		
	Observer Longitude	DDD.MMSS		
3.	Compute Sunrise			
	Computo Supcot			
	compute sunset			
5.	To change any variable, go to Step 2 and change			
	only those affected.			
*	DD.MMSS means degrees, decimal point, minutes			
	and seconds. 120.0713 is 120 degrees, 7			
	minutes and 13 seconds.			
**	Southern latitudes and eastern longitudes are			
	expressed as negative values.			
***	HH.MM means hours, decimal point, minutes.			
	2.03 is 2 hours 3 minutes.			
				-

50			07	Pro	gram	Listi	ing l	I				
STÉP KI	EY ENTRY	KEY CODE		сомм	ENTS	STEP K	EY ENTRY	KE	EY CODE		COMN	MENTS
001	*LBLA	21 11				<b>0</b> 57	2	•	02 07			
882	5101	35 01				030 059	3		-62			
003 004	+ 1 D I D	24				868	5		85			
004 005	ST02	ZI 12 35 <b>A</b> 2				861	x		-35			
886	RTN	24				062	TAN		43			
007	#LBLC	21 13				063	RCL3		36 03			
<b>00</b> 8	ST03	35 03				064	HMS→		16 36			
009	RTN	24				065	TAN		43			
010	<b>≭LBL</b> D	21 14				066	X		-35			
011	ST04	35 04				067	CUS-		16 42			
012	RTN	24				000 000	FZ?	10.	23 02 12 17			
013	#LBLE	21 15				A79	CHS	22	-22			
014	3 0	03				871	RCL 4		36 84			
B15	0	-62				872	HMS→		16 36			
A17	3	03	1			873	+		-55			
018	RCL2	36 02				074	1		01			
019	1	81				075	5		05			
020	-	-45				076	÷		-24			
021	х	-35				677	+,		-55			
022	RCL1	36 01				078	1		01			
823	+.	-55				073 889	ے +		-55			
024 025	1	01 -45	ł			081	ENT†		-21			
023	-	-43				082	CLX		-51			
B27	9	02 09				083	X>Y?		16-34			
028	8	08	1			084	6SBa	23	16 11			
029	8	88				<b>8</b> 85	+		-55			
030	х	-35				086	→HMS		16 35			
<b>Ø</b> 31	ST05	35 <b>0</b> 5				087	RTN	<b>.</b>	24			
032	8	68				088	*LBLe	21	16 15			
033	7	07				089	5F2 CTOE	16	21 <b>0</b> 2 99 15			
634	+	-55				030 091	#IRic	21	22 IJ 16 13			
030 076	605	42				092	RCL4	- 1 -	36 Ø4			
038 037	•	02 Ĥ1	1			093	HMS+		16 36			
038	2	02	1			094	+		-55			
039	3	03				<b>0</b> 95	1		01			
848	x	-35				096	5		<b>0</b> 5			
641	RCL5	36 <b>0</b> 5	1			<b>0</b> 97	÷		-24			
042	ENTT	-21				<b>U</b> 98 000	+		-55			
Ø43	+	-55				077 199	1		01 02			
044 045	2	<b>U</b> Z 80	1			100	+		-55			
04J 046	+	-55	1			102	2		02			
R47	SIN	41	1			103	4		04	1		
048	6	06	]			104	X>Y?	1	16-34			
049	÷	-24				105	GSBIo	23 )	16 12			
050	-	-45				106	-		-45			
Ø51	CHS	-22				107	→ HMS	1	16 35			
<b>0</b> 52	RCL5	36 05				108	KIN +LPL	24	24	1		
853	1	<b>U</b> 1	1			107	<b>#LDL</b> & 2	21 1	10 11 02	1		
004 055		00 -55	1			111	4		02 Rá	]		
800 856	<u>, 1</u>	-33 42				. 112	RTN		24			
	L				REGI	STERS	16	<u>т-</u>		10		0
0	DAV	mm	<sup>3</sup> الدر	AT	1/11/0	° +	b	1	, ,	Ö		3
S0	S1	S2	S3	///	S4	S5	S6		67	S8		S9
А	E	3		С		D		E			I	

				97	y Progran	n List	ing II			53
STE	р ке	EY ENTRY	KEY C	ODE	COMMENTS	STEP	KEY ENTRY	KEY CODE	COMM	ENTS
	113	*LBLb	21 16 1	12		170				
	114 115	ENIT	-2 -4	45						
	116	RTN	2	24						
1	ı		I							
100										
120										
						180				
			-							
130										
· · · · · · · · · · · · · · · · · · ·										
						190				
140										
		an de alta ana angla da sa								
			-							
						200				
	_									
150										
						210				
			1							
160										
100										
						220				
	_									
				L	LABELS		FLAGS		SET STATUS	
^ ))	qy	BM	ONTH	CLAT	DLN6	SUNRISE	0	FLAGS	TRIG	DISP
a		b		с	d	SUNSET	1		DEG D	FIX
0		1		2	3	4	2	1 🛛		
5		6		7	8	9	3			

Program Title Az	imuth of Sunrise a	ind Sunset		
Contributor's Name	Hewlett-Packard			
Address 1000	N.E. Circle Blvd.			
City Corvallis	5	State	Oregon	Zip Code 97330
Program Description	, Equations, Variables			
	This program compute rises or sets. Input data latitude.	s the true heading (azin are day of the month,	muth) of the sun a month of the year	as it and
	The azimuth of the sum	is given by		
		$Az = cos^{-1} \frac{sin \phi_s}{cos \phi_0}$		
	$\phi_{\rm s}$ is the latitude $\phi_{\rm o}$ is the latitude	of the subsolar point of the observer		
	$\phi_{\rm s}$ is approximate	ed by	9 66) where day is	s the
	$\varphi_{s} = 0.3 - day c$	of the year.	<i>yyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyyy</i>	
Operating Limits and	Warnings			
The approximat	ions used in this	program limit th	ne overall ac	curacy to = $1\%$ .
Significant er	rors can occur at	or above the and	tic circles a	nd their respective
poles during c	ertain times of th	e vear.		

This program has been verified only with respect to the numerical example given in *Program Description II*. User accepts and uses this program material AT HIS OWN RISK, in reliance solely upon his own inspection of the program material and without reliance upon any representation or description concerning the program material.

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Sketch(es)			
Sample Broblem/			
	5)		
	Sample Problem		
	What is the azimuth of sunset on Christ $(27^{\circ}, 27', 1)^2$	mas day for an observer in	
	San Francisco (37-37-10):		
			• • • • • • • • • • • • • • • • • • • •
Solution(s)	Solution		
	Answer: 240.51 degrees		
	Azimuth of Sunrise and Sunset		
	Keystrokes	See Displayed	
	25 A 12 B 37.37 C E	240.51	
Reference (s)			
	This program is a direct to a		
	Aviation Pac.	cion of a program from t	the HP-65

<b>1</b>	Azimuth of Sunrise and Sunset	5
DAY	MONTH LAT RISE SET	

STEP	INSTRUCTIONS	INPUT DATA/UNITS	KEYS	OUTPUT DATA/UNITS
1.	Enter program			
2	Input all of the following			
	Day of the month	Dav	Α	
	Month (lan = 1 $Doc = 12$ )	Month	В	
	$\frac{1}{2} \frac{1}{2} \frac{1}$		C	
	Observer's latitude	DD.MM32~		
3.	Calculate either or both			
	Azimuth of Sunrise		D	
	Azimuth of Sunset		Ε	
Λ	Go to stop three to shappe any input veriable			
4.	uo to step three to thanye any input variable			
	NOTE: Azimuth is given as a true azimuth not			
	magnetic.			
+				
	DD.MMSS means degrees, decimal point, minutes			
	minutes and 12 seconds			
	minutes and 15 seconds.			

#### Program Listing I

STEP	KEY ENTRY	KEY CODE	Сомм	ENTS	STEP	KE		KEY CODE	CON	MENTS	57
96	)1 *LBLA	21 11			1	<b>8</b> 57	HMS+	16.36			
86	2 ST01	35 01				<b>8</b> 58	COS	42			
08	13 RTN	24				A59	÷	-24			
08	4 ¥LBLB	21 12				868	COS-	16 42			
88	15 STO2	35 <b>0</b> 2				061	3	A3			
88	16 RTN	24				862	6	06 06			
08	17 ¥LBLC	21 13				863	ด้	88			
88	18 STO3	35 03				R64	XZY	-41			
88	19 RTN	24				865	F27	16 23 82			
01	0 *LBLD	21 14				866	-	-45			
01	1 RCL2	36 02				A67	PTN	24			
01	2.	-62				868	#I RI F	21 15			
01	3 4	04				869	SF2	16 21 82			
81	4 X	-35				A7A	CTOD	22 14			
01	5 2	<b>0</b> 2				A71	#IRI J	21 16 14			
61	6.	-62				<b>A</b> 72		-51			
01	7 3	<b>0</b> 3				A73	STUR	75 <b>A</b> R			
01	8 +	-55				A74	PTN	24			
01	9 INT	16 34				A75	P/S	51			
02	9 ST08	35 <b>0</b> 8				015	K/ U	51			
82	21 2	<b>8</b> 2				1		1	1		
02	2 RCL2	36 <b>0</b> 2				+		1	4		
02	3 X <i>≦</i> Y?	16-35				+			1		
82	4 GSBd	23 16 14			080				1 .		
82	5 RCL1	36 01				1			1		
<del>0</del> 2	6 RCL8	36 08							1		
02	27 -	-45				+			1		
82	8 RCL2	36 <b>0</b> 2						1	-		
82	9 1	01							-		
03	10 -	-45				1			-		
03	11 3	03				+		1	1		
03	12 1	01				1		1	1		
03	13 X	-35							-		
03	14 +	-55			090	1		1	1		
03	5.	-62							1		
03	6 9	<b>0</b> 9							1		
03	7 8	<b>0</b> 8							1		
03	86	<b>0</b> 6						1	1		
03	<b>19</b> x	-35							1		
84	0 9	<b>8</b> 9							]		
84	1.	-62							1		
84	26	<b>0</b> 6							]		
84	36	<b>0</b> 6							]		
84	4 +	-55			100				]		
04	5 COS	42							]		
84	62	02							]		
04	7 3	03									
04	8.	-62						[	1		
84	95	<b>0</b> 5					FLAGS		SET STATUS	; 	
05	10 ×	-35				Ц°		FLAGS	/ TRIG	DISF	<b>,</b>
05	1 CHS	-22						ON OFF	X	<b>V</b>	1
05	2.	-62				╧╋				FIX 4	
05	3 5	<b>0</b> 5				ΗĽ				ENG	
85	4 +	-55				3			1		_
05	5 SIN	41				╉┶━			<u>.</u>		
05	6 RCL3	36 03		DEON		1		<b>.</b>			
			3.7	A REGIS	SIEKS		6	7	8	9	
J	1'DAV	mMITL	1°/AT	7	5		5	ľ	OHm 127	2	
50	S1	S2	S3	S4	S5		S6	S7	S8	S9	
	ľ										
A		в	lc		D			E	I		
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NOTES

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Home Construction Estimating	Chemistry
Marketing/Sales	Optics
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Small Business	Earth Sciences
Antennas	Energy Conservation
Butterworth and Chebyshev Filters	Space Science
Thermal and Transport Sciences	Biology
EE (Lab)	Games
Industrial Engineering	Games of Chance
Aeronautical Engineering	Aircraft Operation
Control Systems	Avigation
Beams and Columns	Calendars
High-Level Math	Photo Dark Room
Test Statistics	COGO-Surveying
Geometry	Astrology
<b>Reliability</b> / <b>QA</b>	Forestry

#### AVIGATION

This book contains programs dealing with great circle and rhumb line calculations, dead reckoning, position by one or two VOR's and time and azimuth of sunrise or sunset.

GREAT CIRCLE PLOTTING RHUMB LINE NAVIGATION GREAT CIRCLE NAVIGATION POSITION GIVEN HEADING, SPEED AND TIME LINE OF SIGHT DISTANCE POSITION AND/OR NAVIGATION BY TWO VOR'S POSITION BY ONE VOR DME SPEED CORRECTION AVERAGE WIND VECTOR COURSE CORRECTION TIME OF SUNRISE AND SUNSET

AZIMUTH OF SUNRISE AND SUNSET



		Program	n Listing	I	47
S'		COMMENTS	STEP KEY ENTRY	KEY CODE	
S 071 *L 002 H 003 F 004 S 005 S 005 S 007 H 008 *L 009 S 010 H 011 *L 012 S 013 H 014 *L 015 H 016 F 019 019	ELA 21 11 MS÷ 1€ 3€ CL4 35 04 TO2 35 02 X4Y -41 TG4 35 04 RTN 24 BLB 21 12 TO5 35 05 RTN 24 BLC 21 13 TO6 35 05 RTN 24 BLC 21 14 MS→ 16 36 CL6 36 06 × -35 6 00	COMMENTS	STEP         KEY ENTRY           057         RCL5           058         SIN           059         ×           060         RCL2           061         COS           062         ÷           063         GTO1           064         *LBLD           065         RCL3           066         >HMS           067         RTN           068         *LBLE           069         2           070         ÷           071         4           072         5           073         +           074         TAN           075         LN           076         RTN	<pre>KEY CODE 36 05 41 -35 36 02 42 -24 22 01 21 14 36 03 16 35 24 21 15 02 -24 04 05 -55 43 32 24 5</pre>	L1
020 821 S 822 R 823 824 825 R 826 827 S 828 G 828 G 838 G 838 G 831 X 832 G 833 G 834 R 835 834 R 835 834 R	$\begin{array}{rrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrr$		377 R/S	51	
037 039 040 041 042 043 *L 044 045 R 045	Pi         16-24           ÷         -24           1         61           8         08           0         00           ×         -35           BL1         21           CHS         -22           CL4         36		100 FLAGS		SET STATUS
040 047	1 01		0	FLAGS	TRIG DISP
048 049 050 051 S 052 R 053 →	→R 44 →P 34 R↓ -31 TO3 35 03 CL1 36 01 HMS 16 35		1 2 110 3 GISTERS	ON OFF 0 [2] 1 [2] 2 [2] 3 [2] 3 [2]	DEG 🛛 FIX 🖄 GRAD 🗆 SCI 🗆 RAD 🗆 ENG 🗆 n 🗻
o 054 055 #L	RTN 24 BL2 21-02	16 4 LNG	5 HDG 6 SPE	EN DIST	8 9
so 056 R	CL7 36 07	S4	S5 S6	S7	S8 S9
A.	В	C	D	E	

# Program Comments

This form Library. the progra complete	is you Your c am cont this fo	r vehicle fo omments wil ributor sha rm and mail	or commentin l be reviewe ll be contac to: Hewlet Attent 1000 N Corval	g on program d by the Lib ted to initi t Packard Con ion: Users' .E. Circle B lis, Oregon	s obtained from t rary and when app ate revisions. P mpany Library lvd 97330	he Users' ropriate, lease
Report on Pro	ogram Nun NE OF	SUNRISE &	IID OR SUNSE	т — Us	ERS LIBRARY SOLUTION	NS - AVIGATION
Commenter's	Name:	DAVID G	JONES		· · · · · · · · · · · · · · · · · · ·	
Address: <u>Ne</u>	EWMONT	PROPRIETARY	LIMITED, 5	35 BOURKE	- STREET,	
City	MELB	OURNE,	VICTOR		AUSTRALIA State	3000 Zid Code
Comments:	HERE	ARE TWO	(2) ERR	ORS IN TR	he Program	LISTING.
(a) STEP	107	READS	HMS->	16 36 > →HMS	16 35	
(b) STEP STEP	111	1N SU +	BROUTINE - 55	а" sнол (This is	AN EXTRA - AN	WED BY D NECESSARY-STEP
	113	RTN	24			
	114	* LBLb	21 16 12			
	115	ENT 1	-21			RECEIVED
	116	-	-45			APR 18 1980
	117	RTN	24			USERS LIDIUM
"DOWN FROM NORTH	THESE UNDA DRA HERN	GRRECT ER " IN RKNESS, CLIMES!	rians The The Sour	N MARE HERN HE UPSETTING	IT POSSIBLE MISPHERE TO THOSE OF	FOR US TELL LIGHT YOU IN