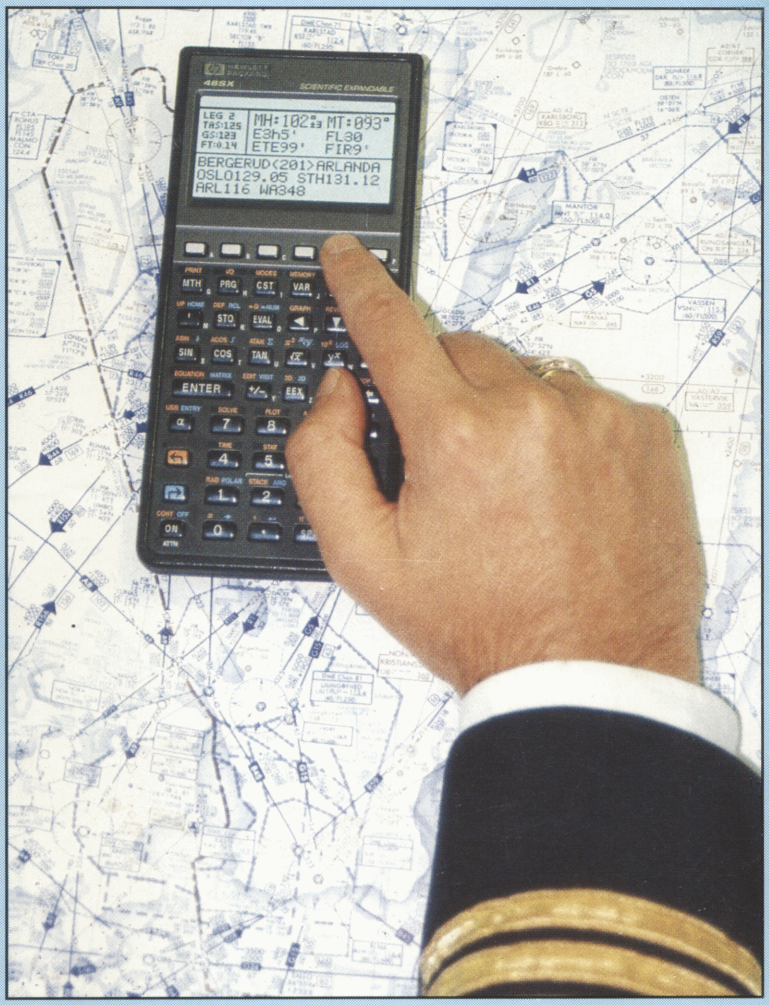
BRINGSLID©
APPLICATION SOFTWARE

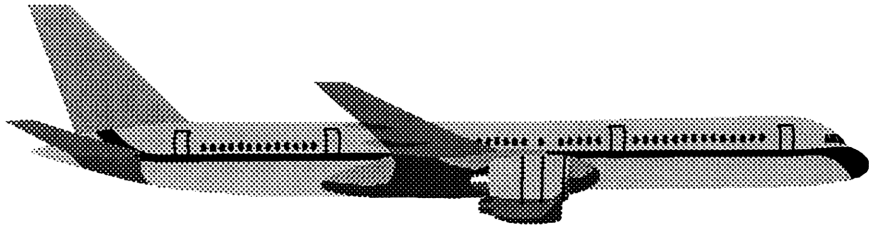


HELGESEN
FLIGHT NAVIGATION SYSTEM

NAVIGATION IS BASED ON DEAD RECKONING, OR USE OF NMEA GPSpac. SENSOR

For HP48 SX/GX

HELGESEN
FLIGHT
NAVIGATION
SYSTEM



Pilot's
Operating Manual

TABLE OF CONTENTS

I. INTRODUCTION

The objective of this software is to serve as an advanced navigation tool for general aviation pilots. It should not be regarded as a training manual in air navigation.

The users for this software are pilots with a theoretical and practical knowledge at the level of private pilot. This is required in order to understand and gain benefit from this software.

Some definitions have been given in appendix A.

WARNING: PROGRAM AND DATA ERRORS ARE POSSIBLE. IT IS THE USER/PILOT SOLE RESPONSIBILITY TO VERIFY THE CORRECTNESS OF ALL FLIGHT PLANS. THE HELGESEN FLIGHT NAVIGATION SYSTEM IS PROVIDED FOR ADVISORY PURPOSES ONLY.

If very unrealistic data are entered into the program, the output might be even more unrealistic, or even worse the output might make sense.

Remember: Garbage in - garbage out.

Important:
Limitation of Liability

This manual and any examples contained herein are provided "as is" and are subject to change without notice.

Tor Helgesen makes no warranty of any kind with regard to this software, including, but not limited to the implied warranties of merchant ability and fitness for a particular purpose.

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II. SYSTEM DESCRIPTION

This program is designed as a Flight Management System (FMS). Flight navigation is based on Dead Reckoning (DR) (and the use of GPS position if a GPS engine is connected).

In navigation mode this program uses the system clock inside the HP48 to estimate time related outputs (Endurance, ETE, ETA, etc.).

The distance, heading and track information are determined by using the latitudinal and longitudinal axis and the magnetic variation.

Flight plans can be printed on a A4 (or American letter) format, from a standard RS232 ASCI printer.

This program support GPS engines with NMEA-0183-GGA protocol and RS232 interface.

To use the calculator during flight you must make sure it is fastened, so that it does not float around. A good idea is to attach self-gripping fasteners under the calculator and on top of your knee board.

The system is divided into six different modes (ENTRY, ROUTE, NAVIGATION, GPS, CHECK LIST & FLIGHT LOG) that serve different applications. Next follows a short description of the different applications:

[GPS]

Will enter the GPS mode, (from navigation or entry mode).

[SPE]

Speed planning before flight. An input application.

[MET]

Meteorology planning before flight. An input application (QNH, temperature, wind, etc.).

[ROUTE]

This mode is divided into five different applications related to the loading and generation/update of flight plans (**[GET]**, **[EDIT]**, **[MAKE]**, **[TRAN]** & **[RVIEW]**).

[GET] will get and load an already made flight plan.

[EDIT] will allow you to edit the communication and navigation frequencies in an old flight plan.

[MAKE] will start generation of a new flight plans.

[TRAN] for route transfer between HP48's.

[RVIEW] will show route names together with the names of the arriving and departing airdrome.

[ANA]

Analyse before making a route. Can calculate rhumb line and great circle track and distance between two way points and make way points along a great circle line given distance between way points. E6B calculations (wind, speed, altitude, rate of climb and turn performance calculations) is also available.

[UNITS]

Set-up application for units to be used for input and output.

[LPATT]

Will calculate and display magnetic headings that are used in the landing pattern (downwind, base and finale).

[W&B] Weight and balance calculations.

[CLIST]

This mode will access the Check List applications.

[NAV]

Will check the format of the loaded route and enter the Navigation mode. Will first show name of departing and arriving airports and distance in nautical miles.

[PRINT] will print the flight plan.

[RS232] will test the baud rate and parity of the RS232 interface.

[←R] will invert the flight plan.

You can review all information related to way points by pushing **[RFIX]**.

[MAP] will plot way points into a grid chart so the route can be viewed. A list of the 10 last way point names is also displayed.

[ETE] will calculate and display route times before start.

By pressing **[START]** the first navigation screen will appear. This will show information related to the take-off airport (Runways, Elevation, nav & com frequencies).

At take off you must push the key that is most convenient for you to use for the initial leg. You will then get navigational parameters related to the first leg on the screen. To get the parameters for the next leg push the same key once again.

If you push any other key than the one selected for the initial leg, a menu will appear, allowing you to change some of the inputs that might change during flight (TAS, Wind, Temperature, Flight Level, Flight Rules, etc.). From this menu you have access to many applications that are useful during flight:

[ΔW/V] will calculate spot wind direction and velocity, and enter this into the flight plan.

[ΔBD] will calculate Bellamy drift.

[LAND] will display information related to the landing at the destination including ILS frequencies and wind triangles for each runway.

[TIME] will start the stopwatch.

[←PT] will graph and show headings and tracks for a left procedure turn together with timing.

[PT→] will graph and show headings and track for a right procedure turn together with timing.

[HOLD] will graph and show headings and track for a race track holding pattern together with timing.

[←1.ST] will make the flight plan go back to the first leg.

[-D→] allow you to select way points to approach direct (bypass way points along the route). The five next way points in the flight plan will be displayed, so that you can select the one to approach, or you can specify a new temporary way point.

[FLOG] will start the Flight Log application.

III. CONTROLS (MENUS)

ENTRY Menu

ROUTE MANAGEMENT Menu

METEOROLOGY Menu

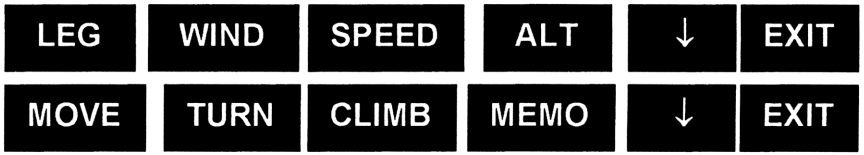
SPEED PLAN Menu

GPS Menu

GPS SETUP Menu

UNIT Menu

WEIGHT & BALANCE Menu



ANALYSE Menu

LEG ANALYSE Menu

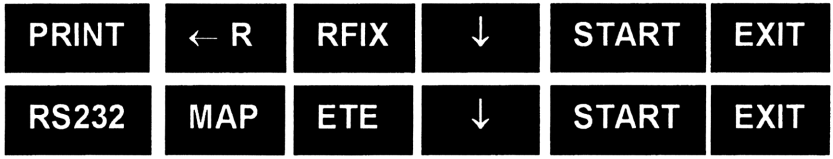
WIND ANALYSE Menu

SPEED ANALYSE Menu

ALTITUDE ANALYSE Menu

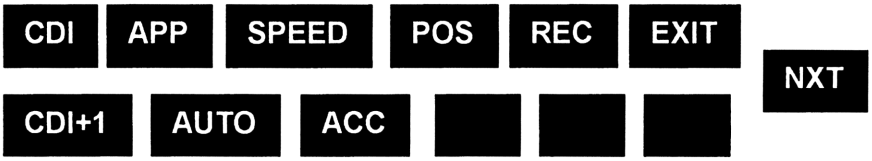
TURN PERFORMANCE Menu

RATE OF CLIMB Menu

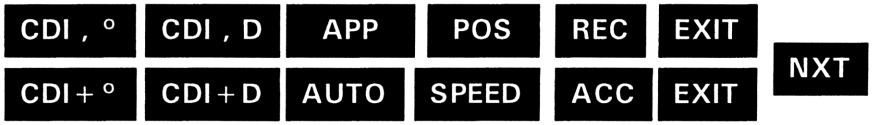


1.st NAVIGATION Menu

2.nd NAVIGATION Menu



NAVIGATION GPS Menu



NAVIGATION GPS Menu

IV. SYSTEM OPERATION

0. SYNTAX

This software use different types of inputs. In the ROUTE mode most of the inputs are programmed to accept alphanumeric inputs. The alpha flag will then show at the top of the display.

As a general rule during input the text will ask you to SELECT, ENTER or LIST:

* SELECT means to use the menu keys.

* ENTER means to push the ENTER key.

* LIST means to input several numbers with space between, and then ENTER.

* If more than one line are used for input, use the **[⩛]** key.

The position parameters use the following input syntax:
DD.MMSS

NOTE: North are positive numbers, South are negative numbers. & East are positive numbers, West are negative numbers. Use the [+/-] key.

1. GETTING STARTED

After the ROM card have been inserted into the HP48, turn it on. Go to **[LIBRARY]** and push **[HFNS]**, then the following menu will show:

To better protect your data, it is recommended to make a directory for use together with this ROM card.

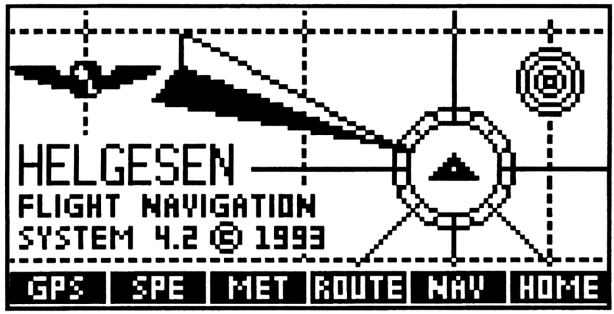
By pushing the **[INST]** key, directories will be generated for NAVIGATION, CHECK LIST & FLIGHT LOG.
In addition your CST menu will be added with the **[FNAV]**, **[CLIST]** & **[FLOG]** functions.

During installation you will be asked two questions:

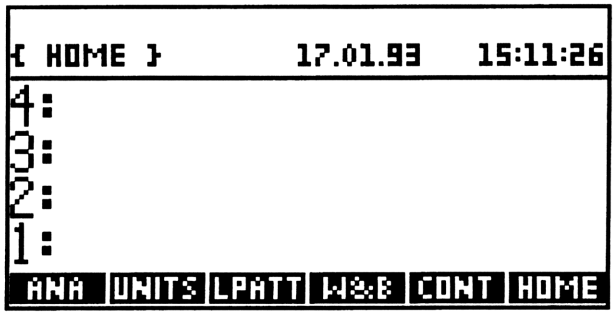
1) if you want to use the **[EVAL]** key to toggle between CHECK LIST & NAVIGATION. This is recommended if you plan to use the CLIST application.

2) if you want the program to generate check list. This can be useful the first time, so that you can see how it works. You can always purge these check lists later.

By pushing the **[FNAV]** key, these display will show.



Push the menu key for the desired application or mode.



By pushing **[NXT]** this display will appear, with more menus.

Another **[NXT]** will return the first menu.

*** NAVIGATION QUICK START**
To quickly get started, (to get an idea of how this program works), push **Shift Left + [NAV]**. This will generate a test route together with all necessary input parameters, and start navigation.

Before you can enter the navigation mode (**[NAV]**) you must enter the speed (**[SPE]**) and meteorological (**[MET]**) parameters.

You also need to load a route, this have to be made first and then loaded. This is done in the ROUTE mode (**[ROUTE]**).

The general idea is that a route can be used several times, but the speed and meteorological conditions might vary from time to time.

The input that have been entered will be stored in the HP48 and will remain until you change or delete them.

The route files might occupy a lot of memory if you have many routes. To avoid memory saturation in the HP48 you can transfer old routes to a PC, and transfer them back whenever needed.

Many of the applications are programs that run continuously. To prevent the batteries to drain out, make sure to exit all running programs before you put the computer away after use,

2. SPEED PLANNING INPUT

This is an input application that must be completed before flight. When you are in the entry mode push **[SPE]** and the display below will appear.

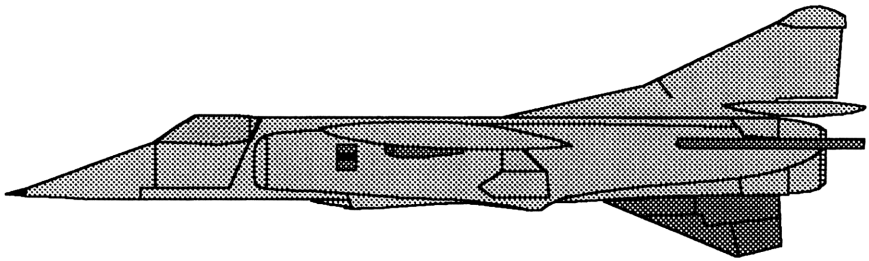
CAS Cruise is used to calculate TAS Cruise, which is a function of temperature and altitude entered in **[MET]**.

[BELL] has two options ON or OFF. This is used with the flag warnings that are part of the navigation program (low fuel, check fuel and keynr). BELL ON means acoustic sound together with flag warnings, and error messages.

SPEED PLAN	BELL OFF
CAS Cruise	120kt
TAS Climb	80kt
TAS Descend	120kt
TAS Landing	75kt
Climb Rate	500fpm
Descend Rate	500fpm
CAS | TAS | RATE	BELL | EXIT

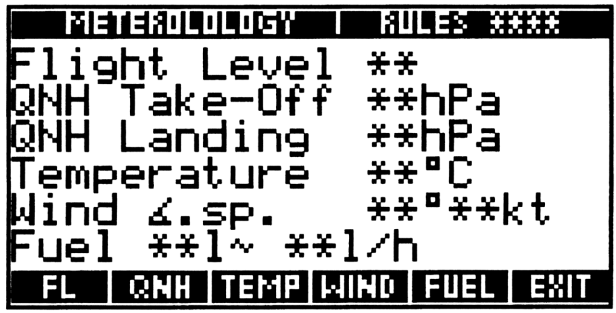
After input, the speed parameters for this flight might look like this.

These parameters have been entered by push of the menu key applicable to the text on the screen.



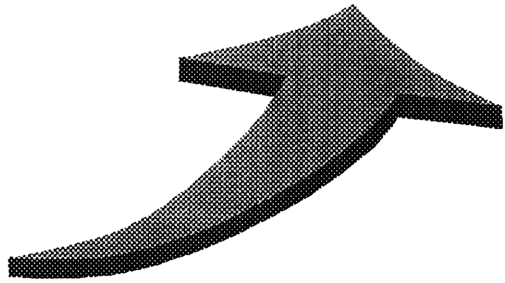
3. *METEOROLOGICAL DATA INPUT*

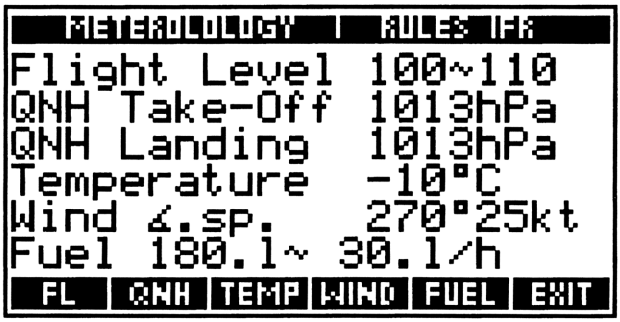
This input application must also be completed before flight. The input procedure is the same as for **[SPE]**.



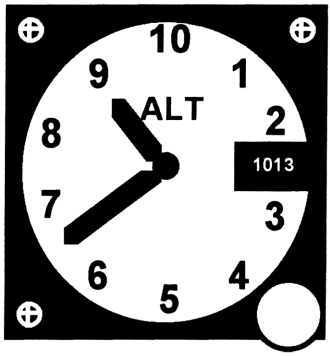
This is the opening display before any inputs have been entered.

Fuel load & fuel flow is used to calculate endurance during navigation (units gallon or litre).

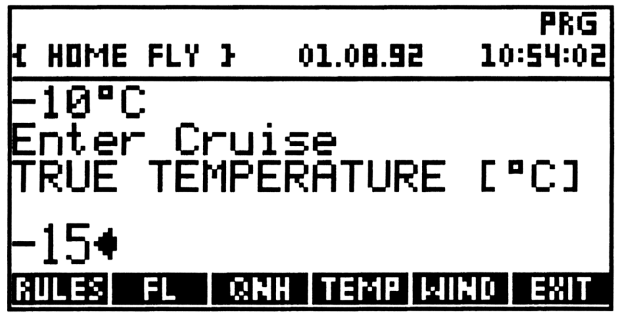




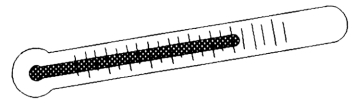
After input, it might look like this. Flight Rules and Flight Level are related so that when you enter minimum Flight Level and select IFR as Flight Rules, you will get two Flight Levels on the display. This is the closest ICAO Standard Semicircular Flight Levels above the minimum that you entered.



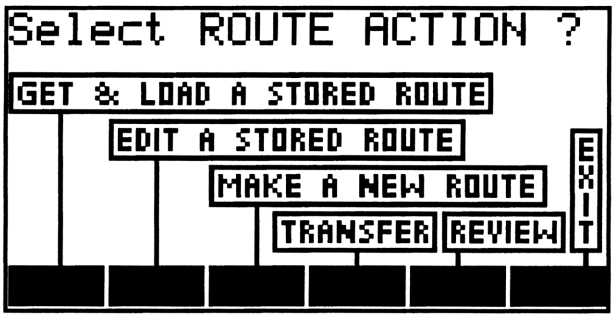
In navigation, Magnetic Track decide which of the two Flight Levels to use. Possible flight rules are; **[IFR]**, **[VFR]** and **[NONE]**. If you select **[NONE]** no ICAO level will be calculated.



If you want to change the entered data, this is how the input is done. At the top the current value is shown. To return without change simply push the **[ENTER]** key with the input line empty.



4. ROUTE MANAGEMENT



Push **[ROUTE]** and this display will appear. The first time you enter this mode there will be no routes to get or edit, so you have to make a route.

It is much easier to plan the route on paper before you start entering data. In appendix C you will find a form for this.

To get this pre-flight-plan-form printed, to an RS232 ASCI printer, push **Shift left + [ROUTE]**.

Push **[MAKE]** and you have started a sequence of questions:

FROM AERODROME ?

< enter name of departing airport >

TO AERODROME ?

< enter name of destination >

Elevation [ft]
at departing airport

< enter number >

LIST RUNWAYs
at departing airport

< enter a list of runways with space between. Runway number between 01 and 36 >

Enter
ILS frequency RW XX
at departing airport

< enter frequency or enter empty line if not applicable. This question will be asked for all runways listed for this airport >

Elevation [ft]
at destination

< enter number >

LIST RUNWAYs
at destination

< enter a list of runways with space between. Runway nr. between 01 & 36 >

Enter
ILS frequency RW XX
at destination

< enter frequency or enter empty line if not applicable. This question will be asked for all runways listed for this airport >

[DD.MMSS] : dep. airport
:Lat. [+N-S]:
:Lon. [+E-W]:
:Var. [+E-W]:

< enter Latitude, Longitude and Variance for departing airport >

departing airport
Enter
COMMUNICATION Id & Fre

< enter text with id and frequency related to the communication (TWR, GND, APP, DEP) at the departing airport. Only one line. >

departing airport
Enter
NAVIGATION Id & Fre

< enter text with id and frequency related to the navigation (VOR, NDB, DME, TACAN) at the departing airport. Only one line. >

Route dep - arr
Last fix : departing airport
Enter NAME of next fix

< enter a text to identify the next fix. If you enter the name of the destination the program will recognise that this is the last fix >

The following questions will be repeated for each fix until you enter a fix name identical to the destination name.

[DD.MMSS] : fix name
:Lat. [+N-S]:
:Lon. [+E-W]:
:Var. [+E-W]:

< enter Latitude, Longitude and Variance for this fix. syntax: degrees before the decimal point and minutes followed by seconds after the decimal point >

fix name
Enter
COMMUNICATION Id & Fre

< enter text with id and frequency related to the communication (TWR, APP, DEP, CNT) at this fix. Only one line. You can enter without text if there is no change in the communication between the previous fix. >

fix name
Enter
NAVIGATION Id & Fre

< enter text with id and frequency related to the navigation (VOR, NDB, DME, TACAN) at this fix. Only one line. You can enter without text if there is no change in the communication between the previous fix. >

Route dep - arr
Last fix : fix name
Enter NAME of next fix

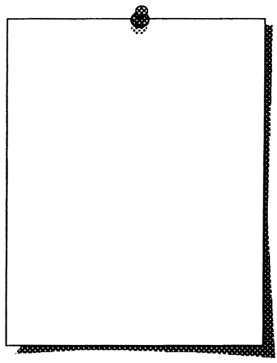
< enter a text to identify the next fix. If you enter the name of the destination the program will recognise that this is the last fix >

NOTE: To enable the navigation to find the estimated time to FIR, you must include a fix in the route with the position of the FIR crossing point. This way point must be named FIR.

The last question will look like this:

Route dep - arr
Enter NAME OF ROUTE

<The name that you specify at this point will be your identification of this route. You must make sure that you don't specify a name that already exist as a file in the directory you are working in. If you do this question will reappear. See appendix B. >



This is how the display look like when you enter the name of the departing aerodrome.

NOTE: It is very important to make a space between the runway numbers.

When you previously have stored routes in the current directory, push **[ROUTE]** and then push **[GET]**. The menu will change and include all route names and you will get the following question:

SELECT ROUTE..
& ENTER

*< Push the menu key with the name of the route that you want and enter. If you have more than six routes use the **[NXT]** key. >*

If all parameters in **[SPE]** and **[MET]** have been checked and accepted you are ready to enter the navigation mode. Push **[NAV]**.

[EDIT] is similar to **[MAKE]** except that you have access only to areas where communication, navigation and ILS are stored.

When you enter name of a route that has been edited, you have to use a name different from the name of the route you edited. This means that after you have edited a route you will end up with two routes. A backup of the old route and the new route.

If you want to purge one of these routes, they will be visible as variables (**[VAR]**).

To edit all parameters (including latitude, longitude and variation) use the **VISIT** command on the HP48SX, or the **EDIT** command on the HP48GX, which are explained in the HP48 users manual.

The program will suggest a name different from the route that was edited at the end of **[EDIT]**.

[TRAN] is used for transfer of routes between HP48's.

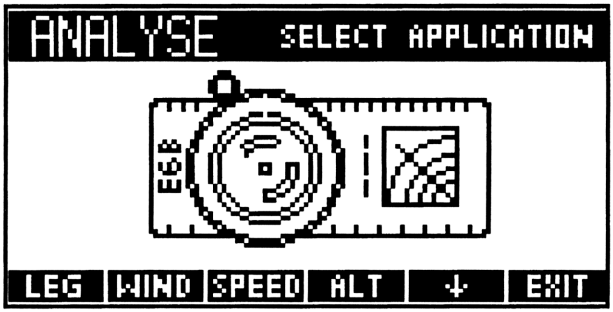
[RVIEW] will show previously stored routes (6 at the time) with name of file and airodrome names.

5. HOME

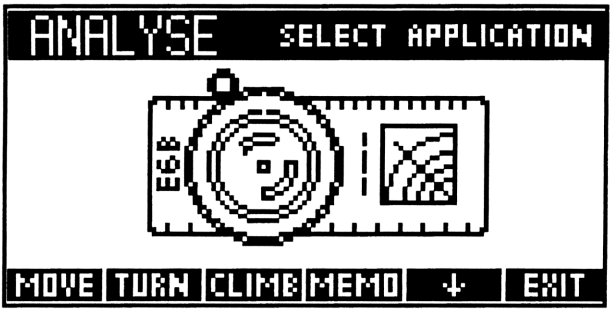
[HOME] is an HP48 command that will move the working area from the current directory to the home directory.

6. ANALYSE

This application will bring the menu below to the display, allowing you to make analysis and E6B calculations.



This menu has two pages, use the [↓] key to toggle between these.



[LEG]

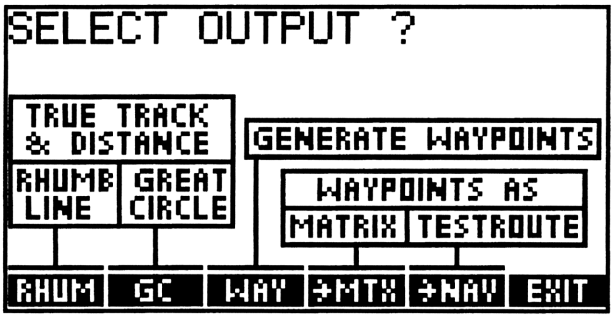
This is an analyse application that will allow you to measure distance and track between two positions.

Push **[LEG]** to enter this program. Then you have to answer two questions:

```
FROM FIX [DD.MMSS]?
:Lat[+N-S]: 00.0000
:Lon[+E-W]: 00.0000

TO FIX [DD.MMSS]?
:Lat[+N-S]: 00.0000
:Lon[+E-W]: 00.0000
```

Positions from the last leg in navigation are suggested as inputs. If no route is valid 00.0000 will be suggested. You can change the data effectively by use of the edit menu that is active at this input questions.

When these two positions have been entered you can start to analyse.



[RHUMB] will generate two lines of output in the display. These are the Rhumb line True Track and the Rhumb line Distance in nautical miles.

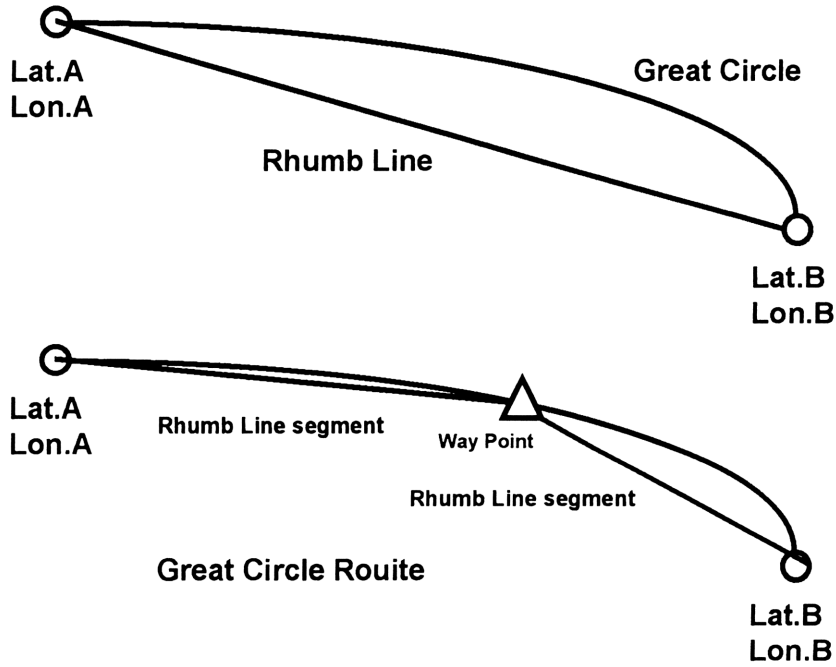
[GC] will generate the Grate Circle True Track and the Great Circle Distance in nautical miles.

[WAY] will make rhumb line segments and store the way points (latitude and longitude) along a great circle route between the two specified fixes. You will be asked for the wanted distance between fixes before it generate a file with these way points. Total distance and efficiency in percent compared to the great circle distance will be displayed.

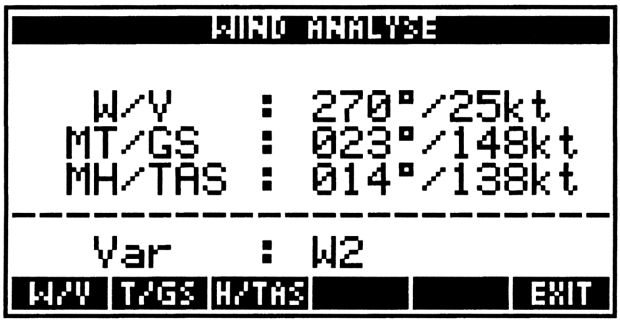
[→NAV] will generate a flight plan file, make it the current route and exit from analyse, so that this route can be tested in **[NAV]**.

[→MTX] will generate a matrix of the way points (latitude and longitude) so that they can be viewed as a matrix (push **[⍒]**).

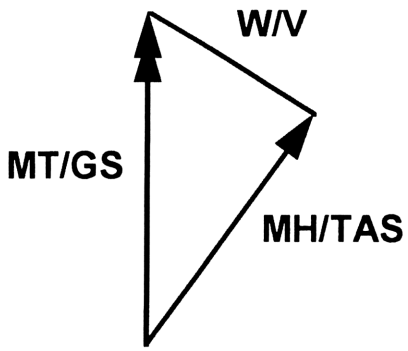
You must run **[WAY]** before **[→NAV]** and **[→MTX]** can be used.



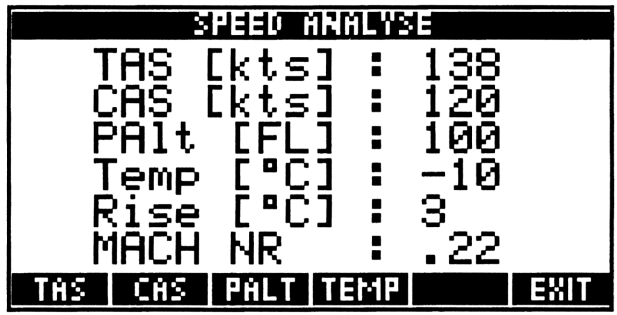
[WIND] analyse will use inputs from last flight plan at start up. Use the menu keys to select the output vector that you want to calculate. The other vectors will be asked as inputs.



Wind calculations will give the relations between; W/V, MT/GS and MH/TAS, (Magnetic Variation will also be included in this calculation because Wind has true North as reference).



[SPEED] will start with inputs from last leg in the flight plan. Use the menu keys to select desired output to calculate.

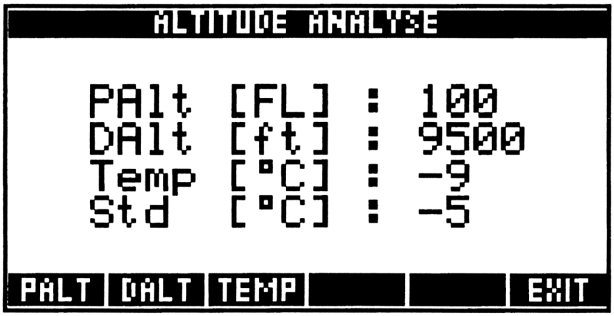


Speed analysis will give the relation between; True Air Speed, Calibrated Air Speed, Flight Level and Temperature.

In addition the MACH NR. and Temperature rise will be calculated.

NOTE: The temperature laps rate changes above FL360, this affect calculations for standard temperature, density altitude and True Air Speed. In addition the rate of air compressibility changes for speeds in excess of MACH 1. This will reduce accuracy for calculations above FL360 and True Air Speed above 660 knots.

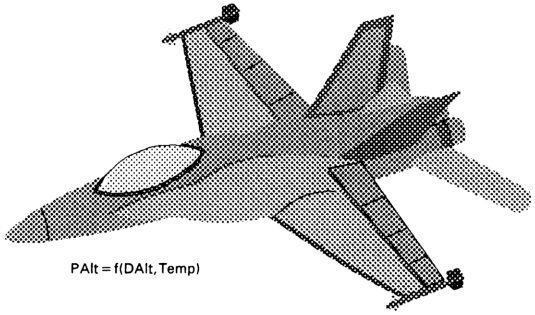
[ALT] will also start with last flight plan data as inputs.



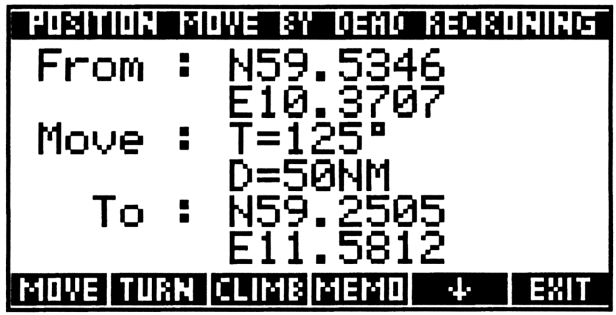
Use the menu keys to select output to calculate.

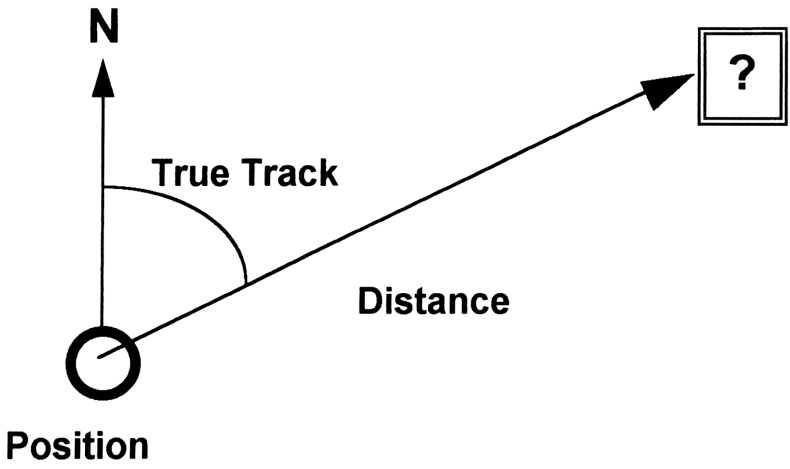
Altitude analysis give the relation between; Pressure Altitude, Density Altitude and Temperature.

In addition the standard temperature for the Flight Level specified will be calculated and displayed on the bottom line of this display.



[MOVE] will calculate a new position (latitude, longitude) from a given position, direction to move and distance to move.

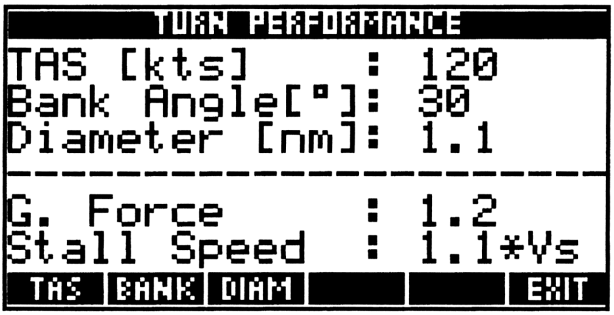


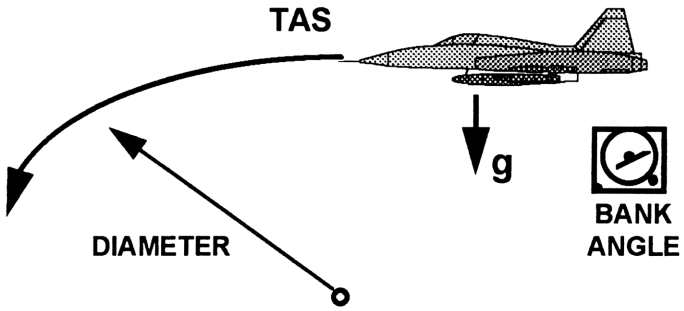


[TURN] will calculate the relations between True Air Speed, Bank Angle and Turn Diameter.

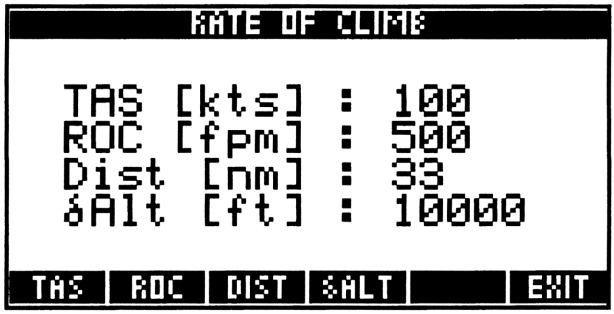
In addition you will get the applicable G. Force and Stall Speed relative to no turn stall speed.

Use the menu keys to select the output to calculate.

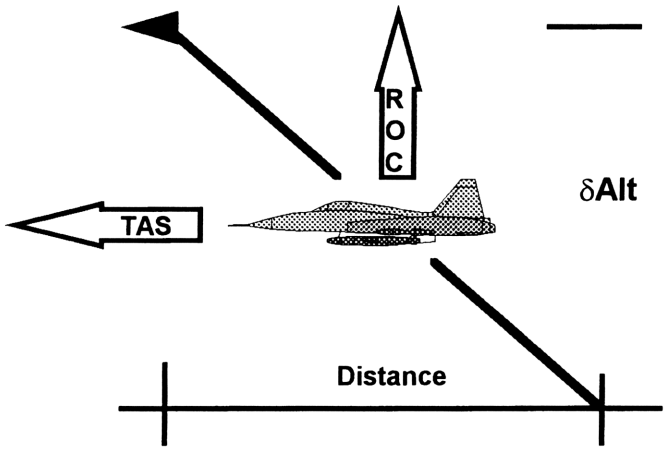




[CLIMB] will calculate the relation between True Air Speed, Rate of Climb, Ground distance and Altitude difference. This can also be used for descend.



Use the menu keys to select the type of calculations to do.



[MEMO] will show in sequence a few graphs of information, like navigational Q codes, SSR mode A codes, the ICAO alphabet with morse codes and light signal codes. You can push any key to get next graph.

Navigational Q-Codes	SSR mode A Codes
QDM MAGNETIC COURSE TO STATION QDR MAGNETIC COURSE FROM STATION QTE TRUE COURSE FROM STATION	7500 Hijack 7600 Com fail 7700 Emegency

MORSE CODES		
ALFA .-	JULIETT .---	SIERRA ...
BRAVO -...	KILO -.-	TANGO -
CHARLIE -.-.	LIMA .-..	UNIFORM ..-
DELTA -..	MIKE --	VICTOR ...-
ECHO .	NOVEMBER -.	WHISKY .--
FOXTROT ..-.	OSCAR ---	XRAY -..-
GOLF --.	PAPA .--.	YANKEE -.--
HOTEL	QUEBEC --.-	ZULU --..
INDIA ..	ROMEO .-.	

LIGHT SIGNALS WHEN ON THE GROUND	
RED	STOP
RED FLASH	CLEAR OF LANDING AREA
GREEN	CLEARED FOR TAKE-OFF
GREEN FLASH	CLEARED TO TAXI
WHITE FLASH	RETURN TO PARKING

LIGHT SIGNALS WHEN IN THE AIR	
RED	GIVE WAY TO OTHER A/C
RED FLASH	DO NOT LAND
GREEN	CLEARED TO LAND
GREEN FLASH	RETURN FOR LANDING
WHITE FLASH	LAND AND PARK

When you exit the analyse application the flight plan variables will return to what they where before you started this application.

7.GPS FROM ENTRY MODE

From the entry mode you can enter the GPS mode with access to the following applications:

- Speed
- Position
- Accuracy
- Record
- Set-up

These applications are explained in chapter 15, GPS APPLICATIONS.

8. UNITS

This program can work with different units for some of the parameters. Push **[UNIT]** and then the unit that is to be changed.

Temperature units: °C or °F.

Pressure units: hPa or inHg.

Volume units: l or Gal.

Mass units: Kg or lb.

9. LANDING PATTERN

For help during touch and go training, **[LPATT]** will calculate Magnetic Headings for the different legs in the landing pattern. A stop clock will start ticking in the display at a key push after the graphic has been displayed. The next key push will exit this application.

You must answer some questions before the headings can be calculated. The suggested data at the top of the display during input are collected from the last flight plan. If the suggested values are acceptable just push **[ENTER]**.

Inputs before calculation;

VARIATION

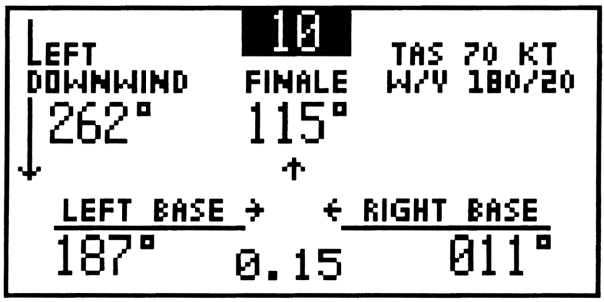
Inbound MAGNETIC TRACK

TRUE AIR SPEED

WIND DIRECTION

WIND SPEED

The input "Inbound Magnetic Track" means the magnetic direction of the runway in degrees.



This is the display that the **[LPATT]** generate.

10. WEIGHT & BALANCE

The first time **[W&B]** is used the following message will appear on the display:

Select
AIRCRAFT W&B LIMITS ?

In the menu you will see two possible options: **[OLD]** and **[NEW]**

Since this is the first time you must push **[NEW]**. This will result in a sequence of questions:

Enter
MAX T/O WEIGHT [unit]

Enter
EMPTY WEIGHT [unit]

Enter
MOMENT ARM
EMPTY AIRCRAFT

Enter
MOMENT ARM
FRONT SEATs

Enter
MOMENT ARM
REAR SEATs

Enter
MOMENT ARM FUEL

Enter
MOMENT ARM BAGGAGE

Enter
C.O.G. LIMITS
:MAX:
:MIN:

Enter
NAME OF AIRCRAFT

The answer to the last question will be the identification (filename) of this data. It is important that you do not use a name that already exist. If you do the question will reappear. Appendix B have a list of all variables that is generated by the program.

A planning form for W&B limits is included as appendix D.

Next time you push **[W&B]** and get the message:

Select
AIRCRAFT W&B LIMITS

Then if you select **[OLD]**, the name will appear in the menu and the message will be:

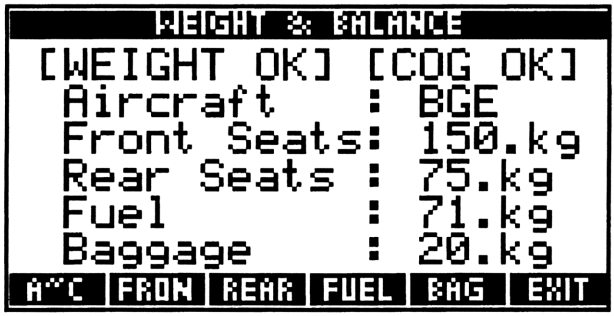
SELECT AIRCRAFT..
& ENTER

Then push the menu key with the name of the aircraft and enter.

Now you have entered the aircraft limits into the equation that will do the weight and balance calculations.

The next step is to enter the actual loading for this flight. This is done by use of the menu keys.

*** W&B QUICK START**
To quickly get an idea of how this works, push **Shift left + [W&B]**. This will generate test variables for this application.



After all data have been entered, the display might look like this.

If you have loaded beyond limits, you will be alerted. Overweight will be quantified. Off balance will not be quantified.

You can use Kg or lb as units for the weight inputs. For the moment arm and c.o.g. limits inputs any unit is valid. It is important to use the same unit for c.o.g. limits as you used for moment arm (cm, in, etc.).

[W&B] is a stand alone application that does not need to be run before navigation. No data entered into **[W&B]** will be used in any other part of the program.

11. CONTINUE NAVIGATION AFTER INTERRUPTION

If you push the **ON** key during navigation, the program will be interrupted and returned to the entry mode.

During flight you might exit the navigation mode to change some of the input parameters that can only be reached in the entry mode.

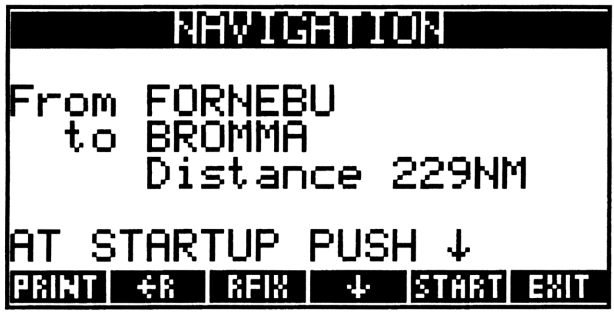
The system time is always running. This means that when you continue after an interruption the flight plan appears to have been running all the time. The only way to reset the system timing is to push the **[NAV]** key in the entry mode, followed by **[START]**.

If you have interrupted the navigation program, and ended up in the entry mode, push **[CONT]** and the navigation program will continue with the current flight plan.

Remaining total distance will be displayed for a few seconds after the **[CONT]** key have been pressed.

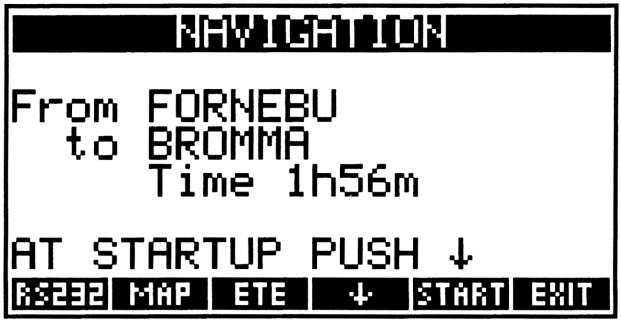
12. NAVIGATION

When you have entered all input data necessary for navigation, push **[NAV]**. After a few seconds the display below will show:



You have now entered the navigation mode. The data have been loaded and checked. The display will tell you the departing aerodrome and the destination together with the total distance for this route.

If you, based on the current input data have too little fuel to conduct this flight you will be told.



This menu has two pages, to toggle between these use the [↓] key.

At this point you can use a few new applications which will be explained next:

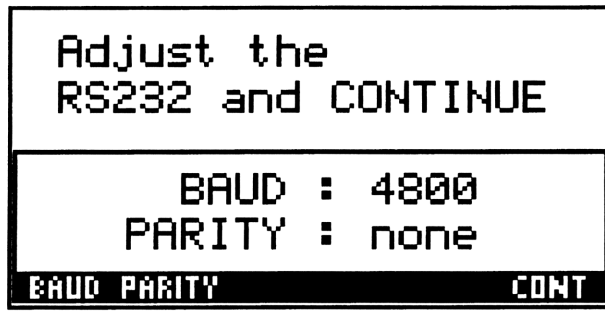
12.1 PRINTING

You can print an A4 (or American letter standard) printout, to all ASCI standard printers with RS232 interface (HP, Canon, Epson, OKI, Star, etc.):

These printouts are available:

- Flight plan (see appendix E).
- Data sheet(see appendix F).
- Planning form (see appendix C).
- Flight Log (see appendix F).

To print the Planning form you have to push **Shift Left** + **[ROUTE]** from the entry mode.



Before print you will be asked to adjust the RS232 Parity and Baud rate.

Make sure your printer is set to 78 characters per line or more (> 10 Characters per inch).
If you use a printer with limited buffer memory, you might have to increase the delay in the PRINTPAR list of the HP48.

The printed flight plan will for every leg include:

- Way point names
- Leg distance
- Magnetic Track
- Magnetic Heading
- Altitude
- True Air Speed
- Ground Speed
- Total time
- ETE
- Endurance

In addition Total Distance and climb/descend flags.

There will be generated a way point at top of climb to exactly indicate where to start cruise. A way point for the start of descend will also be generated.

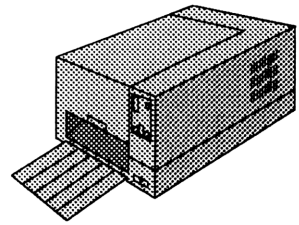
The printed data sheet will include all input and route data used to make the flight plan.

If you do not know the Baud rate and the parity on the printer, there is an application which will determine this for you included in this package.

[RS232] will test all combinations of parity and baud rate to determine how the current printer is connected. This program will send one line at the time to the printer with different parity/baud rate combinations from line to line, so that on the printed paper you can see the proper set-up to use. (This application can also be started from the entry mode by pushing **Shift Right + [ROUTE]**).

To be able to use a standard printer (like the HP Laserjet IIID) you must connect a gender changer to the wire connector. (A gender changer is available from any computer store for a few US$).

If your printer has parallel input only, you can use a serial to parallel converter, or interface via an PC.



If you have purchased the HP82240B Printer, you can use the basic printing command to print the current display. This will work for all parts of this software (remember to select IR in the I/O setup).

Follow these steps;

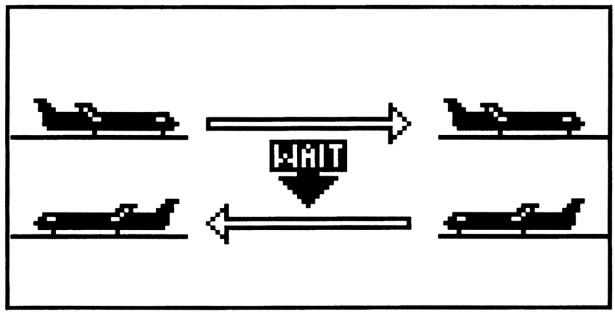
Press and hold the **ON** key.

Press and release the **MTH** key (the key with PRINT written above it).

Release the **ON** key.

If you plan to print all legs before take off to use as back up, you can enter very high values for Climb Rate, so that you do not have to wait for the applicable cruise speed.

12.2 RETURN, INVERTING THE FLIGHT PLAN



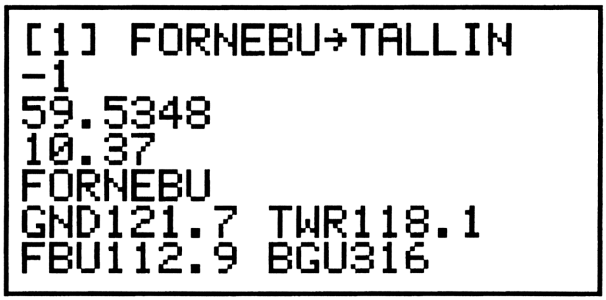
If you are flying the same route back push **[←R]** and the flight plan will turn around so that all fixes will be entered into the navigation program in the opposite sequence. This will be indicated on the display.

This can also be used during flight if you are returning to the airport you started at, without landing at the planed destination. Simply;

Interrupt the navigation (push the **ON** key).
Restart navigation (push **[NAV]**).
Invert (push **[←R]**).
Exit from the first navigation screen (push **[EXIT]**).
Continue (push **[CONT]**).
Use the direct application to build the applicable leg.

12.3 REVIEW WAY POINTS OF THE CURRENT FLIGHT PLAN

If you prefer a look at the fix data in the current route push **[RFIX]**.



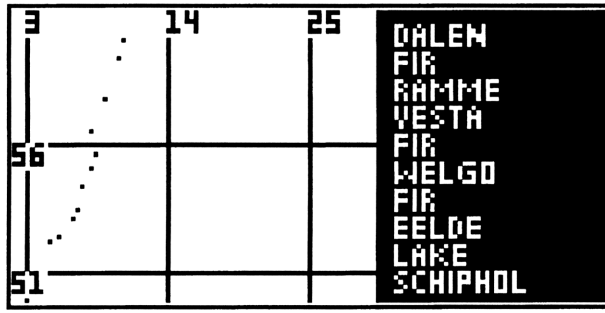
The data are presented in the following sequence:

Fix nr. Route
Variation
Latitude
Longitude
Fix name
Communication
Navigation

Push any key for next fix. Two quick push will exit.
This application is accessible during navigation.

12.4 ROUTE PLOTTED INTO A GRID CHART

You can view the route plotted into a grid chart by pushing **[MAP]**.



This shows how it will look on a route from Oslo, Norway to Amsterdam, Netherlands. The names of the ten last fixes are listed on the right hand side of the display.

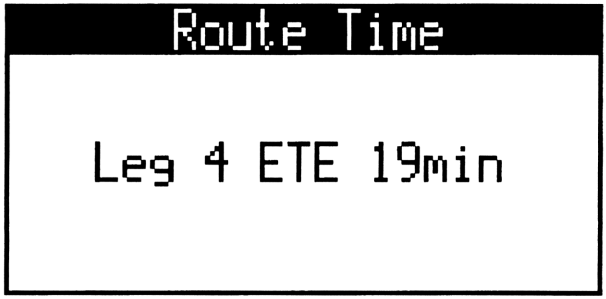
Latitudes (left side of the display) and Longitudes (on top of the display) will be indicated as shown.

Push any key to exit.

12.5 ROUTE TIME

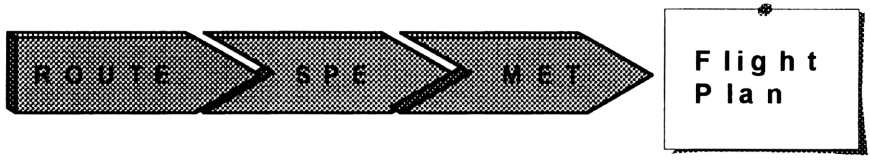
To calculate each leg time and total route time push the **[ETE]** key.

This will calculate each leg time and display it together with leg number as shown on the display below.



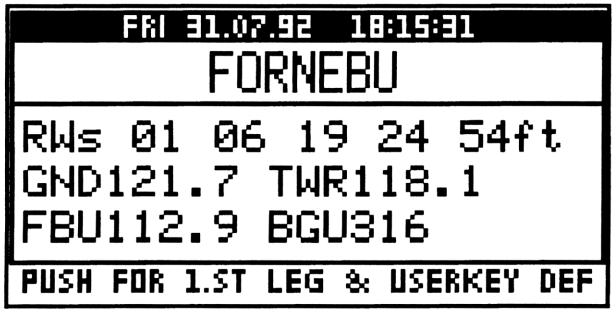
Each leg time will show for a few seconds. After all legs have been calculated the first navigation menu will reappear. The distance line on the display have now been replaced with a time line that show the total flight time for the installed flight plan.

12.6 START NAVIGATION



When you are ready to start the aircraft engine, the flight plan shall also be ready. To start push **[START]**.

The block timing will start and a new display will appear.

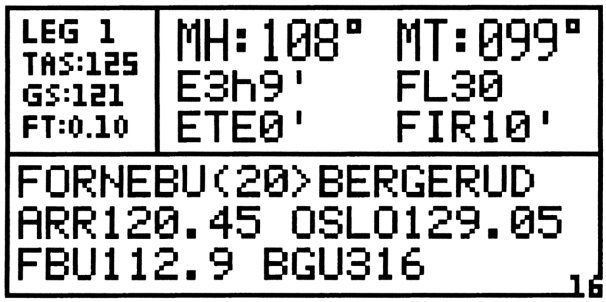


This display will give you the information (runways, elevation, frequencies) required for taxi at the airport you are departing from.

At take off push the key that is most convenient to use for leg progress. Only this key will bring the next leg to the display.

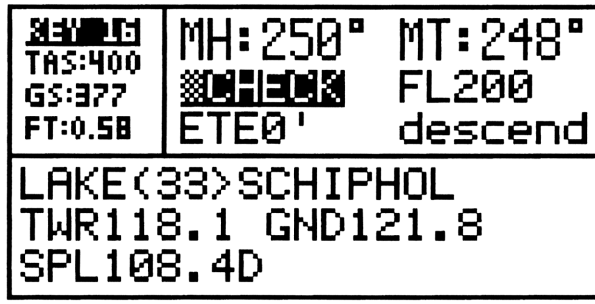
Flight timing will start.

After a few seconds a new display will show with navigational information. This screen is divided into tree different areas.



The most important navigation information is located at the top right area. This include MH (Magnetic Heading), MT (Magnetic Track), E (Endurance), FL (Flight Level for Cruise), ETE (Estimated Time En route) and a field for messages.

The field for messages is used for different information, depending on where you are in the flight plan. During climb this field will indicate the time remaining until established at cruise altitude. In cruise this field is used for FIR (time to first FIR), or if no FIR have been specified in the route ETA (Estimated Time to Arrival). When it is time to start the descend this field will indicate so.

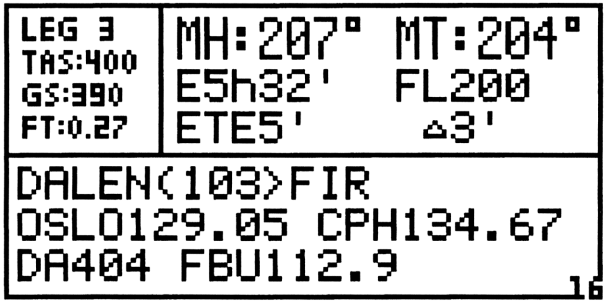


In addition there are some flag warnings connected to the Endurance.

For three minutes around each hour a CHECK flag will flash. This is to alert you to check the fuel tanks and maybe change tank. When there is less than one hour endurance left, a LOW FUEL flag will start flashing.

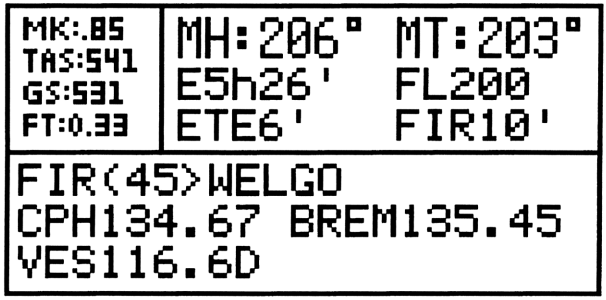
The area at the top left shows the current leg number, TAS (True Air Speed), GS (Ground Speed) and FT (Flight Time, time since take off).

To attract your attention that you are close to the next way point, there will, one minute prior to the estimated time to start next leg, start a flashing flag over the leg number indicating which key you have specified for leg progress. This will remain flashing until you change leg.



This is how a climb situation look like in the navigation mode. (On this figure there are 3 minutes left to climb).

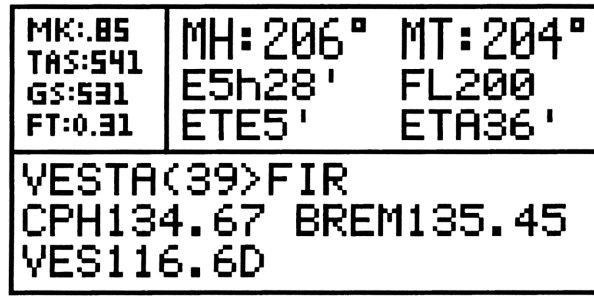
If you always fly below the transition altitude (using QNH as altimeter setting), you should, in order to calculate the most accurate climb and descend time, use 1013hPa (29.92inHg) as input values for QNH Take-off and QNH Landing.



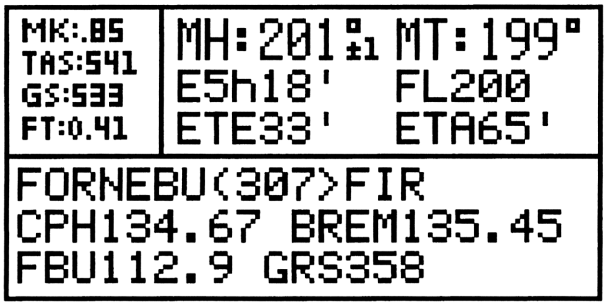
The area at the bottom consist of tree lines of information. At the top you will see where this leg started, the name of the next way point, and the distance between these fixes in nautical miles.

The line in the middle display information related to radio communication. The bottom line display current radio navigation information.

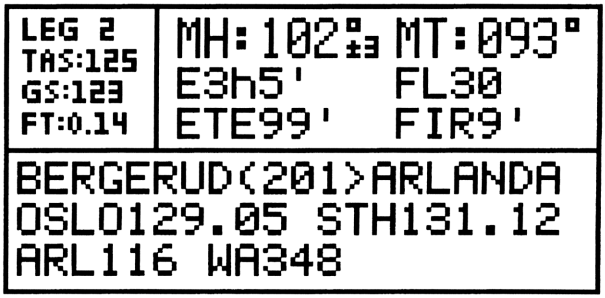
If MACH NUMBER during cruise is higher than 0.5 it will show up flashing where the leg number shows.



You will never experience negative estimated time to FIR. When the estimated time to FIR equals zero the message field will change and display ETA.



If you are on a Eastbound or Westbound leg which is very long, it might be a difference between the rhumb line and the great circle track. If this difference is more than one degree, the rhumb line track and heading will be indicated, with the difference flashing in smaller characters between MH and MT.



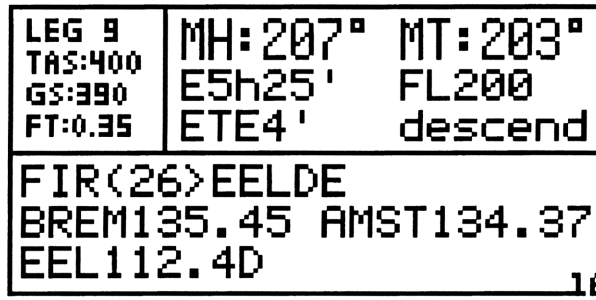
This is how a long Eastbound leg look like. As you can see there is a three degrees difference between rhumb line and great circle on this leg.

The great circle distance will always be used for displayed distance.

You should avoid leg length that has conversion angle greater than one degree.

When you are in the FIR where the arriving aerodrome is located, the ETA will appear. This will also show on all legs before FIR boundaries.

To calculate estimated time to FIR remember to include way points in your route with the FIR crossing position. This way point have to be named FIR in order to be identified and calculated.



Descend flag is on, which mean that ETA is equal to or less than the time needed to do the descend according to rate of descend specified before flight.

As mention before, only one key is valid for the leg progress. If any other key is pushed, a menu will appear on the screen. This will allow you to use some applications during flight.

Applications started from this menu will always return to the navigation at exit.

After return from another application when the navigation is running, the number of the key in use will be displayed in the right bottom corner. This is a two digits integer. The first digit will indicate row (top key row = 1), the last digit indicate column (left column = 1). This is to remind you of which key you are using, in case this was the reason you pushed another key.

If you by accident push a key that bring the menu to the screen, the easiest way back to navigation is to push **[TIME]** twice.

During navigation, the **ON** key will take you back to the entry mode.

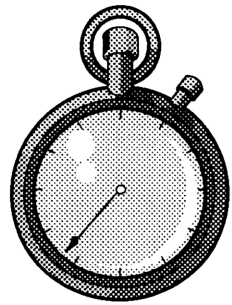
When you stop the engine push **ON** or the progress key (if you are on the last leg). This will interrupt the navigation and display the block time.

13. ACCESSIBLE APPLICATIONS DURING NAVIGATION

During flight you might need to do some calculations, or use some applications.

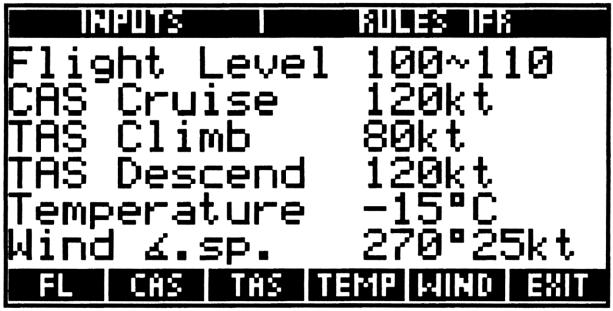
To get access to the application menu during navigation, simply push any key different from the leg progress key (and different from the **ON** key).

This is a menu with two pages so you must use the **[NXT]** key to access all functions.



13.1 CHANGE OF INPUTS.

[→INP] will bring the following menu to the display, allowing you to change the parameters that most likely vary during flight.



Exit will return to navigation with the new parameters installed.

If you need to change inputs available only from the entry mode, interrupt the navigation (the **ON** key), and continue (**[CONT]**) after the inputs have been changed.

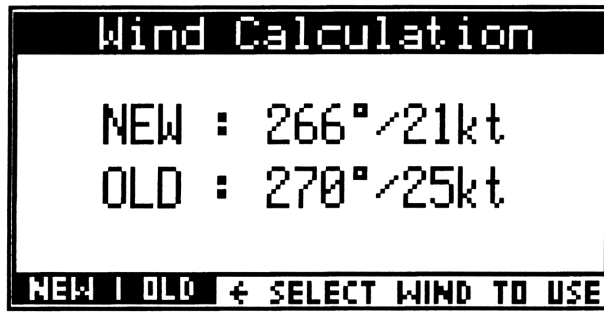
13.2 CALCULATE SPOT WIND

If you feel that the wind information that you are using is incorrect, it might be a good idea to calculate the spot wind. Push **[ΔW/V]** and answer the questions (get the answers from the aircraft instrument panel).

Inputs before calculation:

TRUE AIR SPEED
MAGNETIC HEADING
GROUND SPEED
MAGNETIC TRACK

After calculation the display below will show with the new wind calculated, together with the old wind that currently is used. If you want to change the wind vector in the currently running flight plan select NEW. To exit without change select OLD.



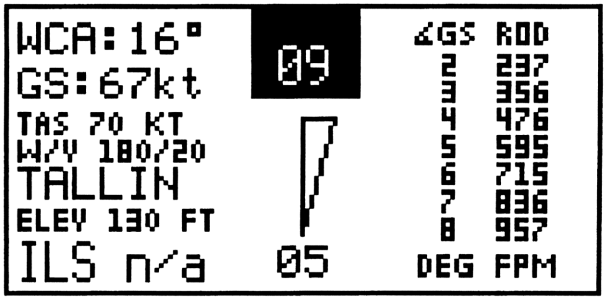
13.3 LANDING

[LAND] will ask for current wind before it starts to scan through all runways at the destination (scanning frequency approx. 10 seconds).

During this scanning, you will have time to evaluate the best runway to approach for landing. A wind triangle will indicate the crab angle for each runway.

When you have decided runway push any key to stop the scan.

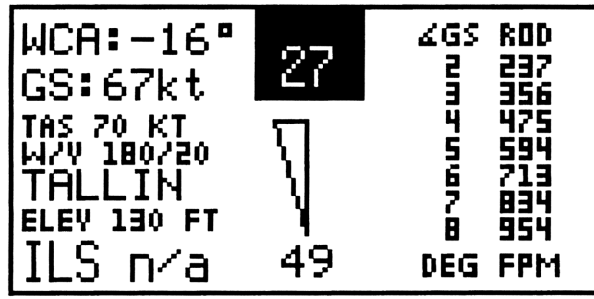
To return to navigation push any key once again.



This is how the landing display is organised with WCA (Wind Correction Angle), GS (Ground Speed), TAS, Wind, name of aerodrome, elevation and ILS frequency if available on the left side of the display.

In the middle you will see the runway nr., the wind triangle and local time in minutes.

The scanning is done without the time visible on the display. The time will show after the scan has been stopped. This is to indicate that the next key will take you back to navigation.



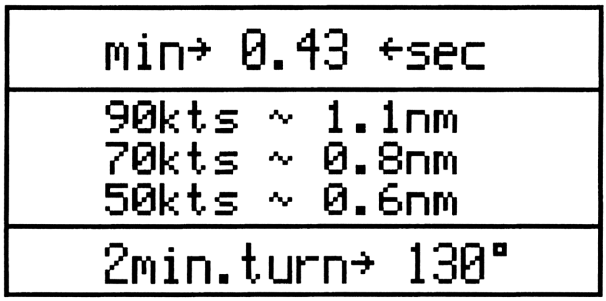
On the right side you will see a table of glide slopes in degrees and the corresponding rate of descend. This will always cover from 2 to 8 degrees.

The TAS used in this application, is the TAS Landing that was specified before take off in **[SPE]**.

13.4 STOP CLOCK

By pushing **[TIME]** you will start the stop clock.

To stop and exit the clock push any key.



This is the display for **[TIME]**. The top line shows the time in minutes and seconds since start.

The next three lines show the distance that corresponds to the speed at the same line. The speed is the landing speed +/- 20 kts.

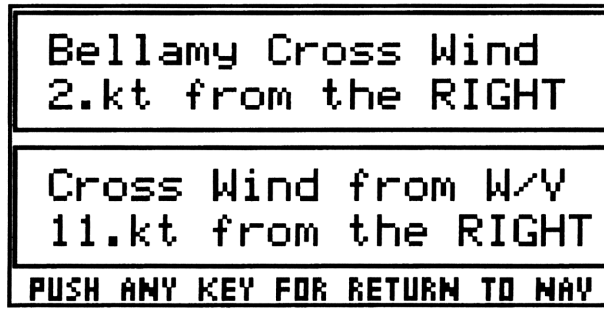
The bottom line shows degrees corresponding to a 2 minutes standard rate turn.

A stop clock function is also included in the **[←PT] [PT→] [HOLD] & [LPATT]** applications.

13.5 BELLAMY DRIFT.

Bellamy Drift calculations for over water cross wind determination can be started by pushing **[ΔBD]**.

This application will calculate your cross wind at the present way point. As input you will be asked for D1 (True Altitude minus Pressure Altitude) at the previous way point and D2 at the present way point.



Bellamy cross wind will be presented together with calculated cross wind from wind vector in use.

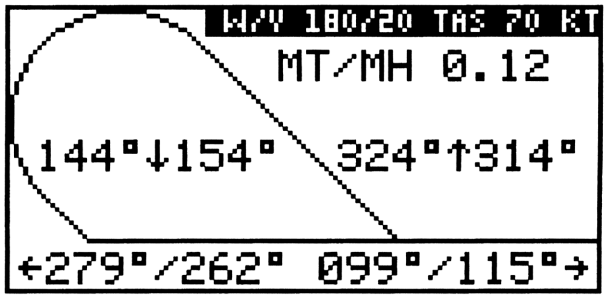
No input data will change as a result of these calculations.

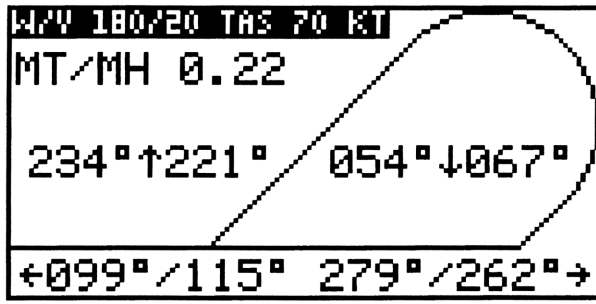
13.6 PROCEDURE TURNS 45°/180°

To display a left 45°/180° procedure turn push **[←PT]**, and answer the questions related to inbound track, air speed and wind.

To display right 45°/180° procedure turn push **[PT→]**. These procedure turns are displayed with all headings and track (magnetic referred to the variance at the current leg).

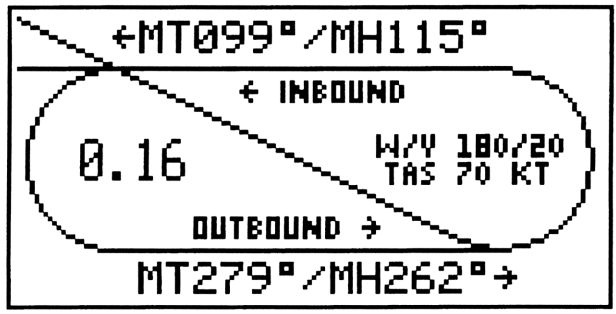
A clock will start ticking at the first key push after the graphic have shown up.





13.7 HOLDING PATTERN

Push **[HOLD]** to display the race track holding pattern, with magnetic track and heading (inbound and outbound).



13.8 RETURNING TO 1.ST LEG

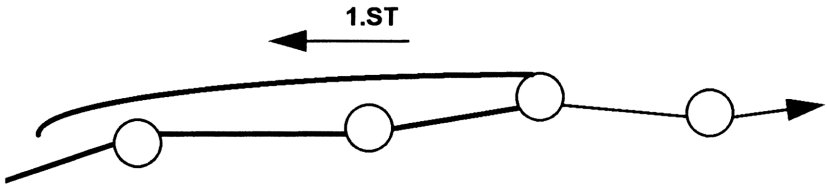
During flight you may have pushed the leg progress key too many times so that the flight plan is ahead of where you actually are. Then you can push **[←1.ST]**. This will take the flight plan back to the first leg, without resetting the flight time that already are accumulated on the clock.

To move up to the desired leg, repeat pressing the leg progress key.

This will not have any effect on the climb timing, the flight timing nor the block timing.

The ETE and the ETA will be recalculated.

FIR timing will be terminated.



13.9 DIRECT TO FUNCTION

If you want to bypass some way points in the flight plan (to go direct), push the **[-D→]** in the menu. Then a display of the next five way points will show. The present way point will appear on the top line. Use the arrow keys to select the desired way point to approach direct, then push **[ENTER]** to return to navigation with the new modified leg entered.

You can generate a new temporary fix into the flight plan from this application by enter from the second line (the "to create a new fix" line).

This new fix will be inserted into the current flight plan before the fix you where aiming at before you entered the direct application.

You will be asked to enter;

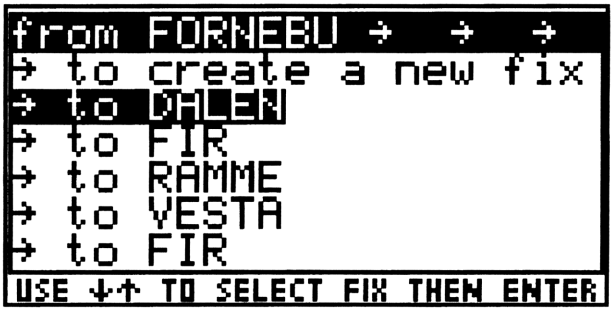
Latitude
Longitude
Variation

This temporary fix will remain in the flight plan until you make a new installation of the route (pushing **[NAV]**).

After a new fix have been created, the new total distance will be calculated and displayed, together with the old distance and the distance increase. To continue the navigation towards this new fix you have to push the [OK] key.

The ETA and ETE will be recalculated, and the
FIR timing will be terminated.

To return to navigation without change, enter line two, then push the **ON** key twice.



This is how the direct display look like. The new leg will go between the two dark way points (lines) when pressing **[ENTER]**.

13.10 GPS DURING NAVIGATION

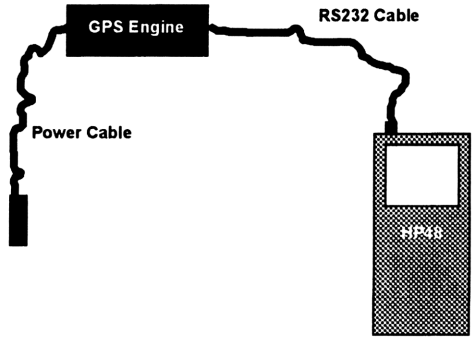
If you enter the GPS mode from the navigation mode, you will be able to enter the following GPS applications;

CDI , °	CDI , D	APP	POS	REC	EXIT	NXT
CDI + °	CDI + D	AUTO	SPEED	ACC	EXIT	

NAVIGATION GPS Menu

This menu will be acctivated by pushing the [GPS] key.

These applications are explained in chapter 15, GPS APPLICATIONS.



14. ALTERNATIVE ROUTES

You might need to divert to an alternative airport.

The best way to go about this is to make two routes, one primary route and one alternative route.

During flight if you decide to divert to your alternative airport and has made an alternative route follow the steps below;

Interrupt the navigation (push the **ON** key).

Get the alternative route (push **[ROUTE]** then **[GET]**).

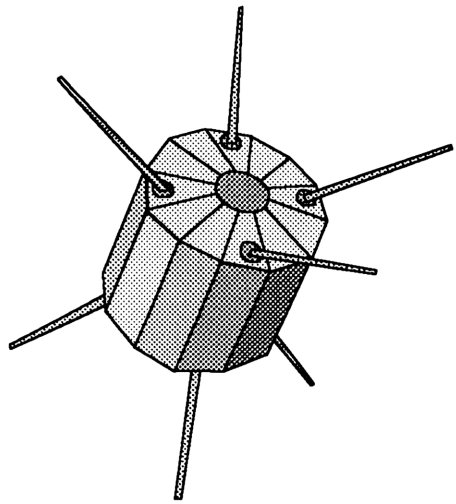
Restart navigation (push **[NAV]**).

Exit from the first navigation screen (push **[EXIT]**).

Continue the navigation from the entry mode with the alternative flight plan installed (push **[CONT]**).

Use the direct application to intercept (push **[-D→]**) .

15.GPS APPLICATIONS



This is a collection of GPS applications with interface to NMEA-0183-GGA protocol GPS receivers, communicating via the RS232.

WARNING: GPS IS NOT APPROVED FOR CIVIL AIR NAVIGATION. IT SHOULD THEREFOR ONLY BE USED AS A SUPPLEMENTAL/ADVISORY TOOL IN ADDITION TO SYSTEMS APPROVED FOR AIR NAVIGATION.

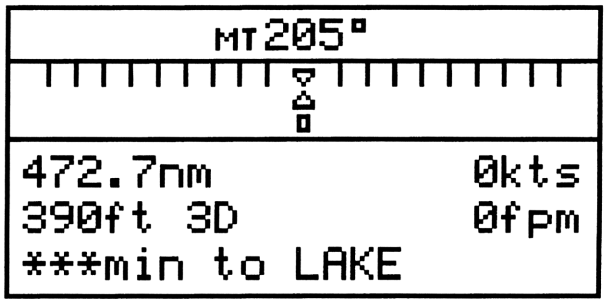
15.1 GPS/CDI (CDI,° CDI,D CDI+° CDI+D)

When starting this application the magnetic track to get to next way point in your route will be calculated and displayed, on the top line of the display.

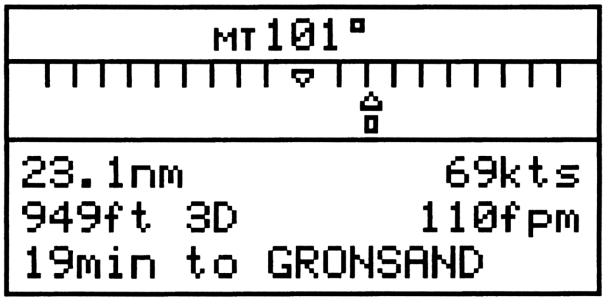
A CDI indicator will indicate offset in degrees (CDI,° & CDI+°) to this track together with an accuracy indicator, as you fly along this leg.

The bottom lines will show:

- Distance to fix [nm]
- Altitude [ft]
- Dimension (2D or 3D)
- Speed towards fix [kts] (if moving)
- Vertical speed [fpm] (if moving)
- Time to fix [min] (if moving)
- Name of next fix



The bar under the moving indicator will give the accuracy. This accuracy wary with satellite geometry (DOP) and the user equivalent range error (UERE) of the GPS system.

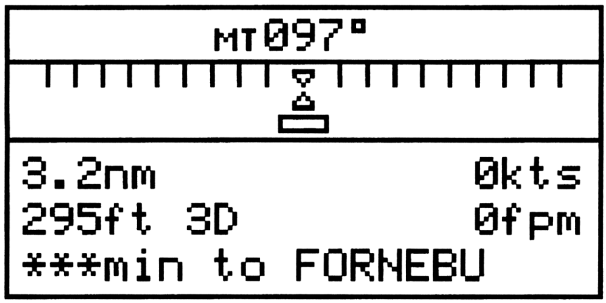


Remember the fixed index on the top line represent the aircraft, and the moving index on the bottom line represent the desired flight track. This means that you should move right to get back on track on the figure above.

The CDI scale represent one degree per division (total +/- 10 degrees). Since the GPS accuracy is given as a distance, the accuracy in degrees will be better if you are 30nm from the fix, compared with 3nm (with the same DOP and UERE).

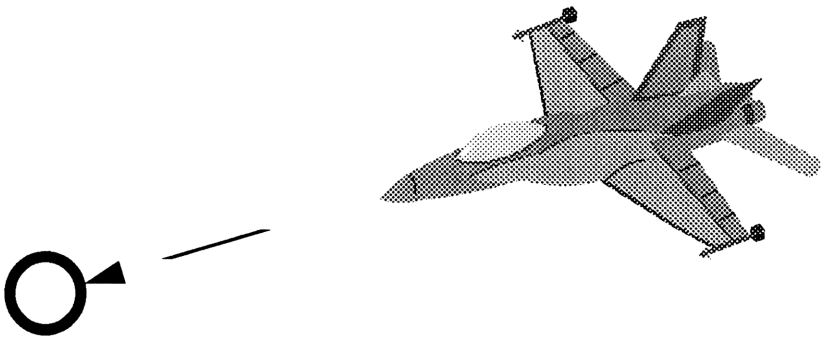
In the GPS/set-up application you can specify a distance for automatic progress. This will automatically change leg when you are this distance away from current fix.

If this automatic progress function has been activated, this will be indicated on the top line of the display.

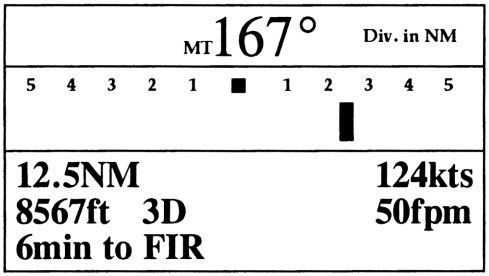


The accuracy bar indicate a two degree accuracy on this figure.

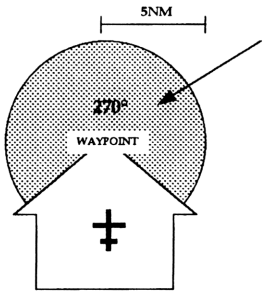
Ground speed indicated will be average over 5 measurements. Vertical speed will be averaged over 10 measurements.



The **[CDI,D]** application will indicate distance diversion in nautical miles. The **[CDI+D]** will install next leg before start.



The CDI,D has an automatic progress function that change to next way point when you reach the fix you are approaching. There are some limitations. The requirement is to be within a defined area, as indicated on the figure below.



When you enter the area limited by a semicircle with radius 5 NM, exept the sector before the waypoint that is less than 45° off track, the next waypoint will automatically be installed.

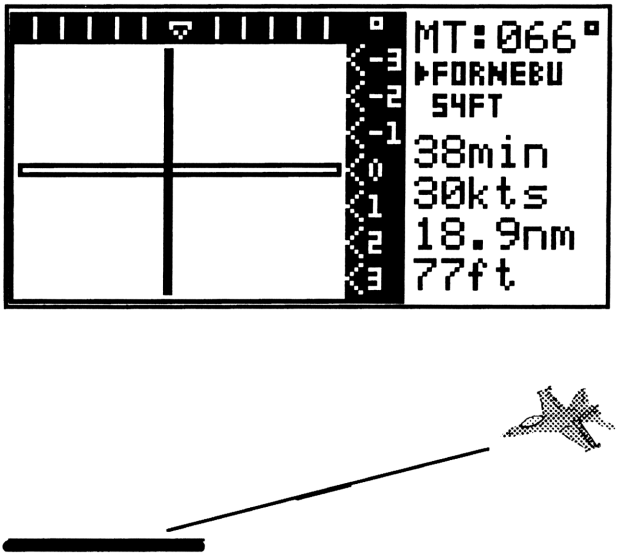
15.2 GPS/APPROACH

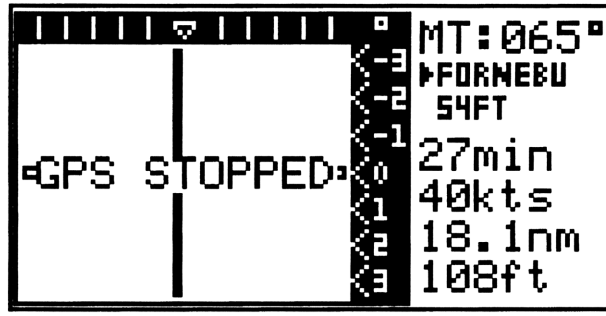
Both track and glide slope will be indicated graphically for approach to the destination airport of current route.

If in 2D (only 3 satellites), the glide slope bar will disappear.

The accuracy information will be included via the size (area) of the indicator bars.

The glide slope scale will at start be set to cover the applicable approach.



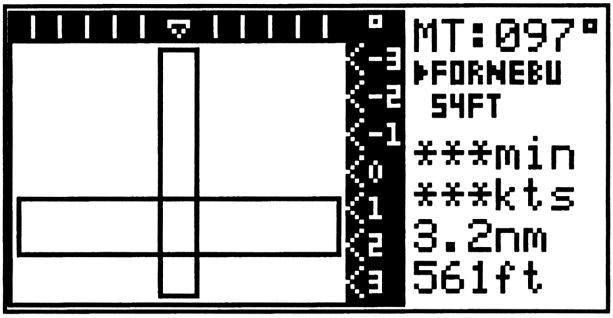


If one measurement fail to give data, a stop flag will be indicated as shown on this figure.

The glide slope scale will use the specified glide slope angle as the center degree, and cover +/- 3 degrees around.

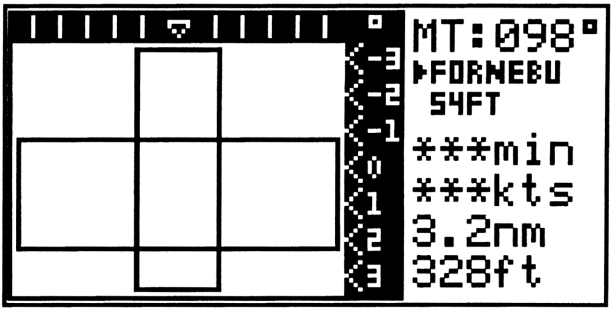
The right side of the display will show:

- Magnetic Track to fly
- Name of airport
- Airport elevation [ft]
- Time [min] (if moving)
- Speed [kts] (if moving)
- Distance [nm]
- Altitude [ft]

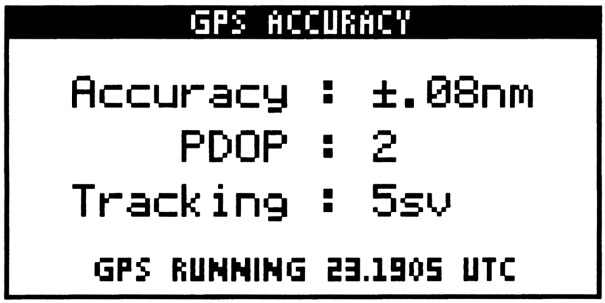


Speed will be the speed component towards the airport. Speed and time will be averaged over 5 measurements.

Both the glide slope bar, and the CDI bar will indicate accuracy based on current DOP and UERE.



15.3 GPS/ACCURACY



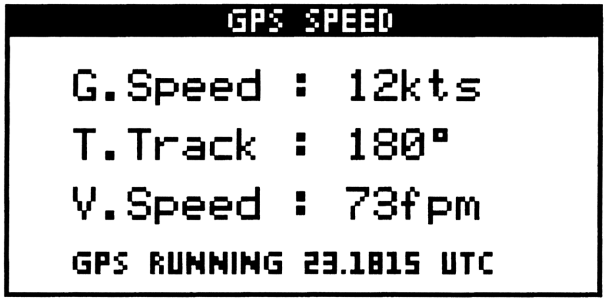
GPS/ACCURACY will indicate current:

- Accuracy [nm]
- PDOP or HDOP
- Satellites tracked
- UTC of last fix [hh.mmss]
- GPS status (running or stopped)

Accuracy is a function of DOP and UERE specified in GPS/set-up.

15.4 GPS/SPEED

Since this speed application is independent from any flight plan that might be running, the indicated speeds is the spot speed.

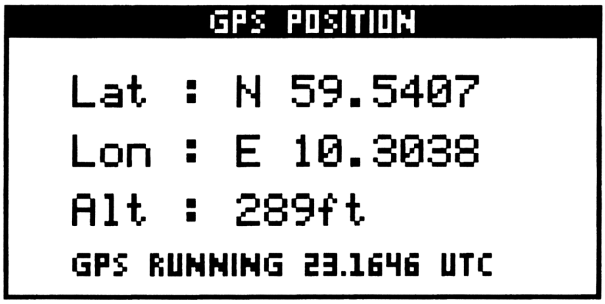


GPS/SPEED includes:

- Ground Speed [kts]
- True Track [degrees]
- Vertical Speed [fpm]
- UTC of last fix [hh.mmss]
- GPS status (running or stopped)

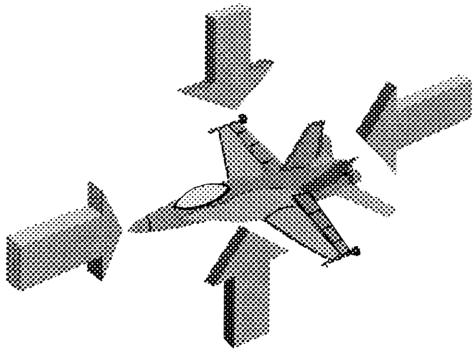
Ground speed indicated will be average over 5 measurements. Vertical speed will be averaged over 10 measurements.

15.5 GPS/POSITION



GPS/POSITION includes:

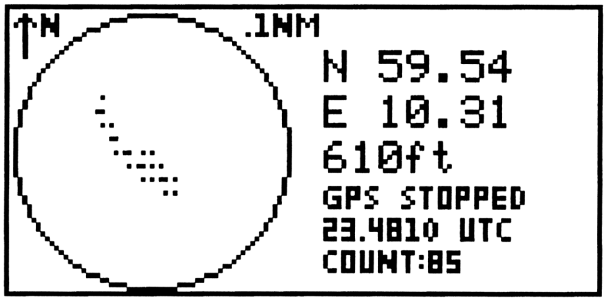
- Latitude [dd.mmss]
- Longitude [ddd.mmss]
- Altitude [ft]
- UTC of last fix [hh.mmss]
- GPS status (running or stopped)



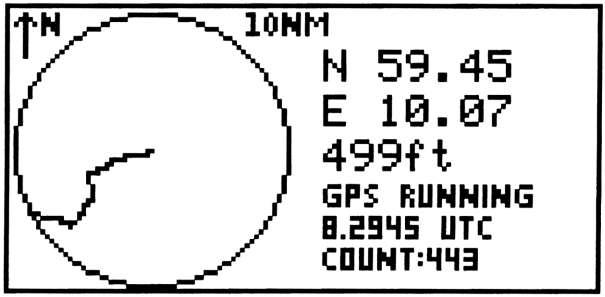
15.6 GPS/RECORD

This application can be used to determine the accuracy if you do not move, and to plot actual track when flying.

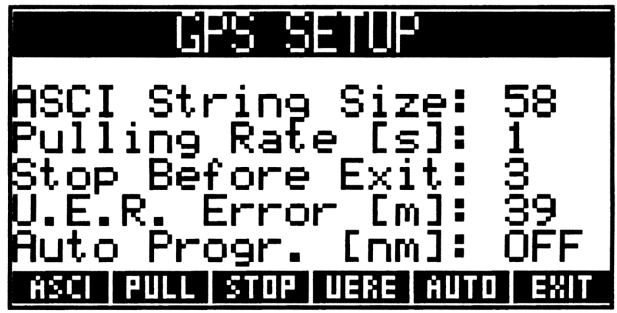
The coverage area will be asked before start.



Right side of the display will show current latitude, longitude, altitude, UTC and number of measurements since start.



15.7 GPS/SETUP



The set-up menu/display is used to specify parameters that might wary on different GPS engines, and some functional features.

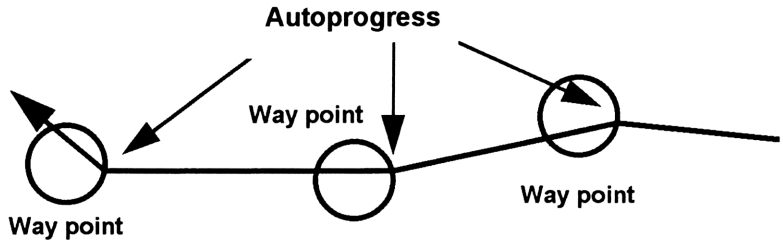
ASCI string size might wary and still follow the NMEA-0183-GGA specification. If your GPS engine has check sum included as part of the format (optional in NMEA-0183), you must make sure the string size is set so that you avoid reading this. This is because the NMEA use * as separator between data and check sum, se next chapter.

Pulling rate wary on different receivers.

Stop before exit is a function that work for all applications except the GPS/RECORD. If the GPS engine stop to send the data string, this function specify how many times/counts you will accept no data from the engine before you exit the application.

User Equivalent Range Error should be specified according to the GPS engines specifications and the status of the GPS satellite systems selective availability.

Auto progress is a function used in CDI. This if activated will automatically change and start tracking next way point when the distance is equal to actual distance. To turn off this function, specify 0.



NOTE: Push any key to exit a GPS application program. If this do not work push the **[ON]** key rapidly twice.

15.8 GPS-NMEA-0183-GGA protocol

The most frequently used protocol for GPS engines are the NMEA-0183. In this specification there are different messages. This software support the reception of the GGA message.

Standard format parameters;

- Baud rate: 4800 bits/sec.
- Data bits: 8 (d7=0)
- Parity: none
- Stop bits: One or more

The GGA message:
$GPGGA,hhmmss.ss,llll.lll,N,yyyyy.yyy,N,q,nn,h.h,a.a,M,g.g,M,t.t,rsid*cs<CR><LF>
Where:

hhmmss.ss	UTC of position
llll.lll	Latitude
yyyyy.yyy	Longitude
q	Quality (0=invalid, 1=GPS, 2=DGPS)
nn	No of satellites used in the fix
h.h	HDOP (2D) or PDOP (3D)
a.a	Antenna Altitude
g.g	Geoid, ellipsoid separation (meters)
N	N/S or E/W marker
M	Units of altitude
t.t,rsid..	Not used

16. USER ERRORS

There are two kinds of error messages included;

INPUT ERROR, which will work during generation and edit of route.

FLIGHT PLAN ERROR, which will work during installation of flight plan.

Errors during navigation will exit and display block time.

To avoid errors remember;

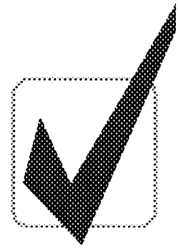
- to enter all input data in SPE and MET before starting NAV.

- to use the **[+/-]** key after the numbers have been typed when making negative numbers. Do not use the **[-]** key.

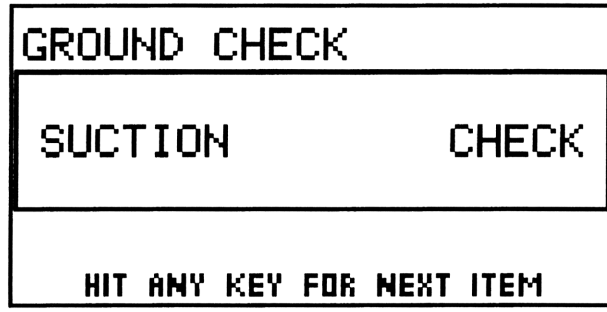
- do not use higher wind speed than the true air speed. This might generate negative or complex ground speed.

- to always have sufficient memory available.

17. CHECK LIST



This application will allow you to use the HP48 as an electronic check list. Check list items must be stored as RAM data. The program can handle many different check lists (handy if you are using several different aircraft's). In order to use more than one check list you must store each set of check list data in different directories.



Each set of check lists contain 12 files that have to be stored individually (file name: LIST.1,LIST.2,,,,LIST.12)

There are 8 normal check lists and 4 emergency check lists which corresponds to the file names below:

NORMAL CHECK LIST

Pre Flight	'LIST.1'
Engine Start	'LIST.2'
Ground Check	'LIST.3'
Take-Off	'LIST.4'
Cruise	'LIST.5'
Descend	'LIST.6'
Landing	'LIST.7'
Miscellaneous	'LIST.8'

EMERGENCY CHECK LIST

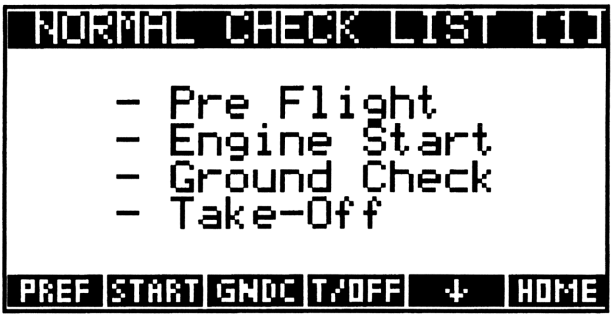
Power Loss	'LIST.9'
Landing	'LIST.10'
Fire	'LIST.11'
Miscellaneous	'LIST.12'

Each item have to be text strings, stored in a list.

Example:

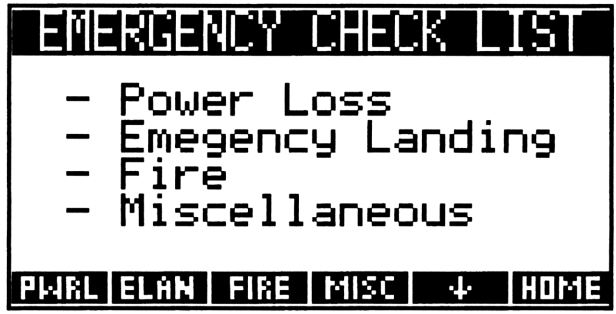
```
{ "BRAKES                    SET"
"CARBURETTOR HEAT    FULL OFF"
"FUEL SELECTOR           DESIRED TANK"
"RADIOS                      OFF"
"THROTTLE                  1/4' OPEN"
"MASTER SWITCH          ON"
"ELECTRIC FUEL PUMP  ON"
"MIXTURE                    FULL RICH"
"STARTER                    ENGAGE"
"THROTTLE                  ADJUST"
"OIL PRESSURE            CHECK" }
'LIST.2' STO
```

To start the check list application push **[CLIST]** in the LIBRARY menu after **[FNAV]** have been pushed. The following display will show after you have pushed the **[CLIST]** key.



This application contain 3 menu pages. 2 for normal check list and one for emergency. To change menu pages use the [↓] key.

This show page two of the check list application.



The emergency check list menu lock like this.

To activate a check list push the menu key applicable to the list you want to use. The first item on the list will show together with a heading conforming the list in use. For next item push any key.

To be able to use the check list application for both an PA28 and an C172, make two directories like this;

`PA28' CRDIR
`C172' CRDIR

Then store the applicable check lists in each directory.

To quickly move from the navigation directory (FLY) to the check list directory use the HOME function. In the HOME directory make the custom menu (CST) like this;

{ {"FNAV"{< < FLY START-FNAV > >}} {"PA28"{< < PA28 CLIST > >}}
{"C172"{< < C172 CLIST > >}} } 'CST' [STO]

This will allow you to use the HOME directory menu to swap between different check lists and the navigation directory.

To assign a user key (example the [EVAL] key) as a toggle key between the FNAV and CLIST the following program can be used:

< < PATH {HOME FLY} IF SAME THEN PA28 CLIST ELSE FLY END > >

This program should then be stored as a user key assignment like this:

33 ASN.

This can be generated during the installation, see chapter IV.1

18. FLIGHT LOG

By pushing the **[FLOG]** key, you will start the FLIGHT LOG application. The first time you enter this mode you will be asked to enter your total flight times as it was 12 months ago.

Flights during the last 12 months should be entered individually by selecting the **RECORD A FLIGHT** function.

By selecting **VIEW TOTAL TIME**, you will get an overview of your total time, and your total over the last 12 months, divided into: DURATION, IN COMMAND, NIGHT, INSTRUMENT & DUAL RECEIVED. You will also see how many landings has been logged the last 90 days.

A flight log containing the last 12 months activity can be printed on an ASCI printer via the RS232, on a A4 page(s), by selecting **PRINT LOG (A4)**.

If you want to look at previous records (last 12 months) on the screen, select **VIEW FLIGHT LOG**.

NOTE: This application use the dialogue box that is part of the 48GX function set, and will not work on the 48SX.

Next page shows the relation between all functions in this application.

```
|||||||| WRITE FLIGHT LOG 10.04.94 ||||||||
A/C " "

NOTE " "

ΣT 0          NT 0          IT 0

L(D) 1        L(N) 0        RT 0

AIRCRAFT IDENT & TYPE ?
```

SELECT LOG ACTION:

RECORD A FLIGHT

VIEW FLIGHT LOG

VIEW TOTAL TIME

PRINT LOG (A4)

SELECT LOG TO VIEW:

LAST

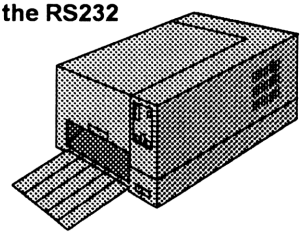
LAST - 1

LAST - 2

LAST - 3

```
|||||||| LOG LAST-1 DATE 1.02.94 ||||||||
A/C "PA28 LN-NAR"

NOTE "ESGP ENFB"

ΣT 1.2        NT 0          IT 0

L(D) 1        L(N) 0        RT 0

AIRCRAFT IDENT & TYPE ?
```

FLIGHT LOG ON PAPER
via the RS232



FLIGHT TIMES	TOTAL	LAST 12M
DURATION	605.15	28.55
IN COMMAND	512.45	28.55
NIGHT	41.30	4.15
INSTRUMENT	308.45	20.45
DUAL RECEIVED	92.30	0.00
NUMBER OF LANDINGS LAST 90 DAYS DAY : 12 NIGHT : 5		

APPENDIX A DEFINITIONS

CALIBRATED AIR SPEED
(CAS). The air speed indicator reading corrected for position (or installation) and instrument errors. (CAS is equal to TAS at sea level in standard atmosphere).

CONVERSION ANGLE
The angular difference between the great circle and the rhumb line.

ENDURANCE
Flying time that is left before the fuel tanks are empty, (with the present fuel load and fuel flow).

ESTIMATED TIME EN ROUTE
(ETE) Estimated flying time remaining to next way point.

ESTIMATED TIME TO ARRIVAL
(ETA) Estimated flying time remaining to reach the destination.

FLIGHT LEVEL
(FL) Pressure altitude in hundreds of feet. (FL50=PA5000feet).

FLIGHT RULES
When an aircraft's position, track and clearance from other aircraft and from ground obstructions are maintained by the pilot's looking outside the aircraft, it is being operated under Visual Flight Rules (VFR). When aircraft control relies solely on instruments, it flies under Instrument Flight Rules (IFR). IFR and VFR use different Flight Levels during cruise flight.

GREAT CIRCLE.
A great circle is a circle on the surface of a sphere, which plane passes through the center of the sphere, dividing it into two equal parts. (If you cut straight through a sphere, the cut edges are circles. Thus, the intersection of a plane with a sphere is a plane bounded by a circle. If the intercepting plane passes through the center of the sphere, dividing the sphere into two equal parts, the circle formed is a great circle).

GROUND SPEED,
(GS) the rate of motion over the ground. The result of interaction between true air speed and wind in their relative directions of motion.

HOLDING PATTERN
is a predetermined maneuver which keeps aircraft within a specified airspace while awaiting further clearance from air traffic control.

ICAO STANDARD SEMICIRCULAR CRUISING LEVELS.
Depending on the flight rules (VFR or IFR), and the magnetic track it is required to cruise in one of the flight levels in the table below:

MT000° - MT179°		MT180° - MT359°	
IFR	VFR	IFR	VFR
10		20	
30	35	40	45
50	55	60	65
70	75	80	85
90	95	100	105
110	115	120	125
130	135	140	145
150	155	160	165
170	175	180	185
190	195	200	205
210	215	220	225
230	235	240	245
250	255	260	265
270	275	280	285
290		310	
330		350	
370		390	
410		430	

LATITUDE
is a point on the latitudinal axis, which range from 0° at the equator to 90° north and 90° south at the poles.

LONGITUDE
is a point on the longitudinal axis, which range from 0° at Greenwich, near London, England, around the earth both eastward and westward through 180°.

MACH NUMBER
A number which relates the aeroplanes speed to the speed of sound. The speed of sound is represented by MK=1.0. Mach number is a function of CAS and PA.

MAGNETIC HEADING
The direction in which the longitudinal axis of the aircraft is pointed with respect to magnetic north.

MAGNETIC TRACK
The actual flight path of an aircraft over the surface of the earth, in degrees from magnetic north.

PRESSURE ALTITUDE
(PA) The altitude read on a standard altimeter when the instrument is adjusted to indicate the height above the standard datum plane (29.92 inHg or 1013.3 hPa).

PROCEDURE TURN
a maneuver designed to reverse direction and establish the aircraft on the intermediate approach segment or final approach track that is part of a standard instrument approach procedure.

QNH
The altimeter setting (in inHg or hPa), that make the altimeter indicate the height above average sea level.

RHUMB LINE
a line on the surface of the earth that cuts all successive meridians at the same angle.

STANDARD ATMOSPHERE.
Pressure and temperature values for any given altitude, arbitrarily established as a standard basis to which all problems related to altitude may be compared. The set of standard conditions presently used is known as the International Standard Atmosphere (ISA). The ISA actually represent the mean or average properties of the atmosphere; that is, it represents the year-round average of the pressure-height temperature soundings observed over a period of years. The standard values include sea level pressure of 1013.2 hPa and a temperature of 15 °C.

TRUE AIR SPEED
(TAS), the air speed of an aircraft relative to undisturbed air. It is equivalent air speed corrected for air-density variation from the standard value at sea level. TAS increases with altitude when indicated air speed remains constant.

TRUE TEMPERATURE
Temperature corrected for temperature rise, which has resulted from the heat of friction and the heat of compressibility of the air. The temperature rise will increase with speed.

VARIATION
The angular difference between true north and magnetic north at the point of measure. This is different from point to point and is slowly changing over time.

WIND CORRECTION ANGEL
(WCA) The angle equal to the difference between aeroplane heading and aeroplane track, which is equal to the wind drift.

APPENDIX B, PROGRAM RAM VARIABLES

NAME	CONTENT
s	CAS Cruise
c	TAS Climb
ds	TAS Descend
ls	TAS Landing
k↑	Climb Rate
k↓	Descend Rate
f	Fuel Load
d	Fuel Flow
ru	Flight Rules
h	Minimum Cruise Altitude
q	QNH Take off
q.	QNH Landing
t	Temperature
w	Wind velocity
v	Wind speed
i.	Front seat weight
ii.	Rear seat weight
iii.	Fuel weight
iv.	Baggage weight
v.	name of aircraft
w&b	active W&B limits
navp	Current route
fpl.	backup fix list
fpl	active fix list

NAME	CONTENT
fr	departing aerodrome
to	name of destination
a	take off elevation
a.	landing elevation
r.	runway info take off
r..	runway info landing
fti	Current flight time
lti	System time at fix
tti	System time at take off
bti	System time at start
eta	E. time to arrival
l	Current leg number
k	Current user key
stk	Last stack content
Θ	Lower ICAO Flight Level
Θ.	Upper ICAO Flight Level
αε	Current Flight Level
mach	mach number
gs	ground speed
tas	true air speed
mh	magnetic heading
mt	magnetic track
ca	Conversion angle

NAME	CONTENT
dis	Distance current leg
fix	Last fix
fix.	Next fix
cfr.	Current com. info.
nfr.	Current nav. info
mes	last message
fir	Distance to all FIR
fir.	Distance to first FIR
td	Total distance
td.	Total segment distance
θa	Last latitude
θb	Next latitude
Θa	Last longitude
Θb	Next longitude
δ	Last variation
δ.	Next variation
Δ	Average variation
ana	analyze file
CST	Custom menu

RAM VARIABLES USED FOR THE GPS APPLICATIONS

NAME	CONTENT
N	GPS help program
S	GPS help program
E	GPS help program
W	GPS help program
M	GPS help program
gpgga	GPS receiver data
asci.gps	Engine ASCI string size
pull.gps	Engine pulling rate
stop.gps	Error pull before exit
uere.gps	User equiv. range error
auto.gps	Auto progress distance

APPENDIX C, ROUTE PLANNING FORM

* HELGESEN PRE FLIGHT PLAN FORM *

Route name:			Prepared by:			Date:
From:	Elev:	ft	RW (ILS Fre):			
To:	Elev:	ft	RW (ILS Fre):			

FIX Name	Lat.	Lon.	Var	COM Id & Fre.	NAV Id & Fre.

APPENDIX D, W&B LIMITS FORM

Name of aircraft:	
Max T/O Weight:	
Empty Weight:	
Moment arm Empty aircraft:	
Moment arm Front seat:	
Moment arm Rear seat:	
Moment arm Fuel:	
Moment arm Baggage:	
C.O.G. Max. limit:	
C.O.G. Min. limit:	

APPENDIX E, FLIGHT PLAN & DATA SHEET

* HELGESEN FLIGHT PLAN *

FORNEBU [518NM] SCHIPHOL

ROUTE	Dist	MT	MH	Alt	TAS	GS	ETE / ATE / TT	Endurance
FORNEBU								6.00
	15	185	203	Climb	80	75	0.12/_____/0.12	
GRONSAND								5.48
	9	206	222	Climb	80	67	0.08/_____/0.20	
Cruise								5.40
	17	206	215	FL100	138	126	0.08/_____/0.28	
DALEN								5.32
	103	204	214	FL100	138	127	0.49/_____/1.16	
FIR								4.44
	77	203	213	FL100	138	127	0.36/_____/1.53	
RAMME								4.07
	53	178	188	FL110	141	140	0.22/_____/2.15	
VESTA								3.45
	39	204	213	FL100	138	127	0.18/_____/2.33	
FIR								3.27
	45	203	213	FL100	138	127	0.21/_____/2.55	
WELGO								3.05
	47	204	213	FL100	138	127	0.22/_____/3.17	
FIR								2.43
	26	203	213	FL100	138	127	0.12/_____/3.29	
EELDE								2.31
	56	229	236	FL100	138	119	0.28/_____/3.57	
LAKE								2.03
	8	249	253	FL100	138	115	0.04/_____/4.01	
Descend								1.59
	25	249	255	Descend	100	77	0.20/_____/4.21	
SCHIPHOL								1.39

* MON 27.09.93 11:41:33 *

* DATA *

CAS Cruise	120kt	Flight Rules	IFR	QNH Take-off	1013hPa
TAS Climb	80kt	Min. Cruise Alt.	FL100	QNH Landing	1013hPa
TAS Descend	100kt	ICAO Levels	100~110	Endurance	6h
Climb Rate	500fpm	Cruise Temp.	-10.C	Fuel Load	180.1
Descend Rate	500fpm	Cruise Wind	270/25	Fuel Flow	30.1/h

WAYPOINT	LATITUDE	LONGITUDE	VAR	COMMUNICATION	NAVIGATION
FORNEBU	N 59.5349	E 10.3659	W2	TWR118.1 GND121.7	FBU112.9 GRS358
GRONSAND	N 59.3909	E 10.3530	W2		
DALEN	N 59.1546	E 10.1530	W2	TWR118.1 APP120.45	DA404 FBU112.9
FIR	N 57.4013	E 9.0157	W2	OSLO129.05 CPH134.67	
RAMME	N 56.2844	E 8.1119	W2		RAM112.3
VESTA	N 55.3613	E 8.1804	W2		VES116.6D
FIR	N 55.0000	E 7.5300	W2	CPH134.67 BREM135.45	
WELGO	N 54.1800	E 7.2500	W2		
FIR	N 53.3354	E 6.5518	W2	BREM135.45 AMST134.37	
EELDE	N 53.0954	E 6.4002	W3		EEL112.4D
LAKE	N 52.3044	E 5.3410	W3	APP121.2 ATIS118.8	LAK347.5
SCHIPHOL	N 52.1705	E 4.4521	W3	TWR118.1 GND121.8	SPL108.4D

Elevation FORNEBU 54 feet

RUNWAYs: 01 06 19 24

ILS freq: 110.3 / 109.7 / / 110.9

Elevation SCHIPHOL -11 feet

RUNWAYs: 01 09 19 27

ILS freq: 110.3 / / 109.7 / 111.5

* MON 27.09.93 11:45:55 *

APPENDIX F, FLIGHT LOG PRINTOUT

* FLIGHT LOG & RECORDS *

29.05.92	Aircraft	Note ACCUMULATED (Older than 12M)	
DURATION	IN COMMAND	NIGHT TIME	INSTRUMENT	DUAL RECEIVE	LANDINGS
191.10	143.55	5.55	8.15	47.15	D 0 N 0

28.05.93	Aircraft C172 LNBGE	Note ENFB ESSB	
DURATION	IN COMMAND	NIGHT TIME	INSTRUMENT	DUAL RECEIVE	LANDINGS
2.20	2.20	0.00	0.00	0.00	D 1 N 0

28.05.93	Aircraft C172 LNBGE	Note ESSB EETN	
DURATION	IN COMMAND	NIGHT TIME	INSTRUMENT	DUAL RECEIVE	LANDINGS
2.50	2.50	0.00	0.00	0.00	D 1 N 0

28.05.93	Aircraft C172 LNBGE	Note EETN EEVI	
DURATION	IN COMMAND	NIGHT TIME	INSTRUMENT	DUAL RECEIVE	LANDINGS
0.40	0.40	0.00	0.00	0.00	D 1 N 0

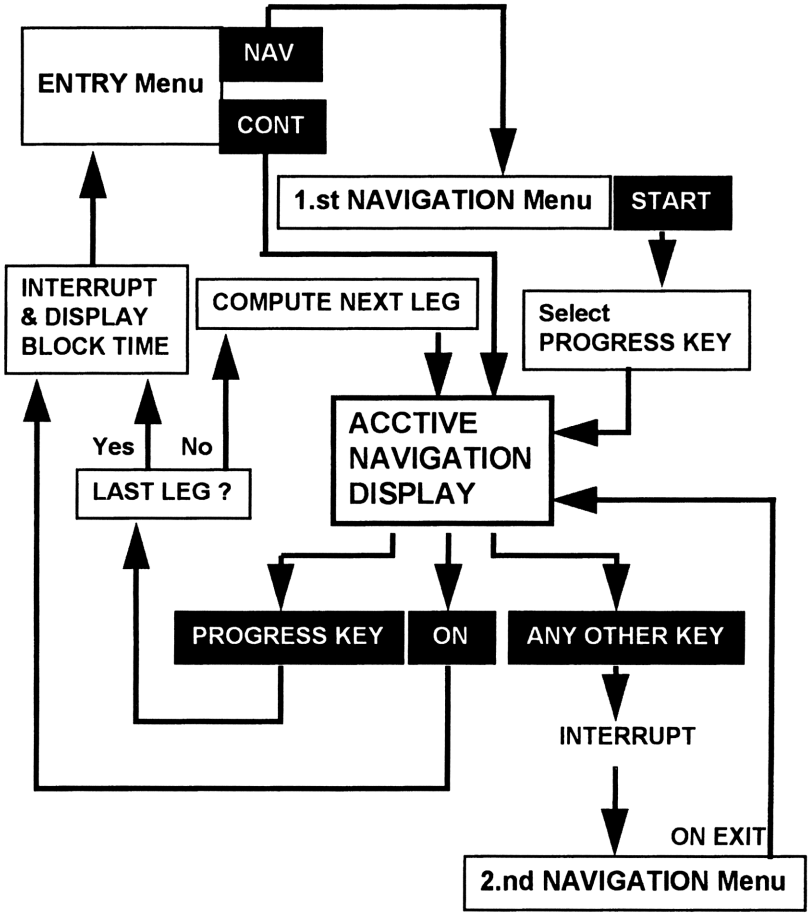
29.05.93	Aircraft C172 LNBGE	Note EEVI EETN	
DURATION	IN COMMAND	NIGHT TIME	INSTRUMENT	DUAL RECEIVE	LANDINGS
0.40	0.40	0.00	0.00	0.00	D 1 N 0

29.05.93	Aircraft C172 LNBGE	Note EETN EFMA	
DURATION	IN COMMAND	NIGHT TIME	INSTRUMENT	DUAL RECEIVE	LANDINGS
2.20	2.20	0.00	0.00	0.00	D 1 N 0

* TOTAL FRI 08.04.94 13:21:27 *

DURATION : 200.00
DUAL RECEIVE : 47.15
IN COMMAND : 152.45
NIGHT : 5.55
INSTRUMENT : 8.15

APPENDIX G, NAVIGATION PROGRAM FLOW



APPENDIX H. INDEX

REGISTRATION

Registration as a user ensures you product update information. To get the latest information and a rebate on future application cards please fill in and post the registration card below.

Place and date of purchase:

_____

Name:_____

Address:_____

_____

City:_____

Zip:_____

Country:_____

Tor Helgesen

Toftesgate 39

0553 OSLO

NORWAY

BRINGSLID©
APPLICATION SOFTWARE

HELGESEN
FLIGHT MANAGEMENT
SYSTEM

Use an interactive flight plan on your next flight, or print a professional flight plan on a A4 (or American letter standard) printer, via the RS232 interface on the HP48.

This program work as a Flight Management System (FMS). Navigation is based on Dead Reckoning (DR), or by use of GPS engine with the NMEA-0138 protocol as input to the RS232 communication interface on the HP48.

DR uses the system clock inside the HP48 SX/GX to estimate time related outputs (Endurance, ETE, ETA, etc.). The distance, heading and track information are determined by using the latitudinal and longitudinal axis and the magnetic variation.

Provides quick and easy access and control of all navigation management features, complete with graphics.

No subscription of data base required.

This represent yet another step ahead.

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