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Stand Alone Prediction System
User Guide

IPS Radio and Space Services. Australia

AUSTRALIA

STAND ALONE PREDICTION SYSTEM

SAPS

User Guide

IBM™ PC Version

Minimum Requirements: 350K; two floppy drives.

Stand Alone Prediction System User Guide

LIST OF FIGURES

1. Introduction

The IPS Stand Alone Prediction System (SAPS) allows the prediction of communications conditions in the HF radio spectrum. It is based on an ionospheric model developed by IPS Radio and Space Services, Sydney.

SAPS is designed for the IBM Personal Computer or compatibles; Models PC, XT, or AT; using DOS versions 2.X and 3.X, with a minimum of 350K memory. Either a color or monochrome display monitor may be used.

Some experience with the MS-DOS operating system is required to install SAPS, also *some* familiarity with a computer keyboard is highly recommended. Should you be unfamiliar with a computer keyboard, please read the section entitled "Special Keys" before proceeding any further.

2. Running SAPS

After following the installation instructions in the file "README" on the first of the disks supplied and typing *saps* to run the program you will see the SAPS title screen. To see the main menu, press any key.

Before continuing to read this manual some of the conventions used by SAPS need to be explained.

2.1 Entering Data

When entering data at any point in the program your input will appear on the screen in regions called *input fields* and are the only parts of the screen you can change. To the left of the input field will be an input prompt indicating what input is expected, followed by a colon, e.g. "month:" will accept the month of a prediction.

The following editing keys are available

left arrow key (←)	This key moves the cursor to the *left* within an input field.
right arrow key (→)	This key moves the cursor to the *right* within an input field.
end key (End)	This key moves the cursor to the *end* of the input in an input field.
home key (Home)	This key moves the cursor to the *beginning* of an input field.
delete key (Del)	This key deletes the character on top of the cursor.
backspace key (←)	This key deletes the character to the left of the cursor.
Function key 3 (F3)	This key clears the input field from the current cursor position to the end of the field.
Function key 5 (F5)	This key clears the entire input field, regardless of the current cursor position.
enter key (Enter)	This key indicates the end of input for the field.

When there are multiple input fields on the screen the following additional keys are available:

down arrow key (↓)	This key moves the cursor to the *next* input field.
up arrow key (↑)	This key moves the cursor to the *previous* input field.
Enter key	This key will now also move the cursor to the *next empty* input field or, if none, to the *next* input field.

These keys are sufficient for you to be able to correct any typing errors you may make. Trying to enter more characters than the input field allows will cause a beep sound and the character will be ignored.

2.2 Using Lists

At several points within the program you will need to make a selection from a list of names shown on the screen. For example these names might be of circuits in the circuit database or files containing saved predictions. Your position in the list will be indicated by a highlighting bar of colour (the "cursor") over a particular name. The following keys are available:

enter key (Enter)	This key selects the highlighted name for further processing.
left arrow key (←)	This key moves the cursor to the *previous* name.
right arrow key (→)	This key moves the cursor to the *next* name.
down arrow key (↓)	This key moves the cursor down a line.
up arrow key (↑)	This key moves the cursor up a line.
page down key (PgDn)	This key shows the next page of the list if any.
page up key (PgUp)	This key shows the previous page of the list if any.
home key (Home)	This key moves the cursor to the first name on the screen.
end key (End)	This key moves the cursor to the last name on the screen.
Function key 25 (Ctrl F5)	This key deletes the name from the list.

2.3 Cancelling

There are two methods of cancelling whatever the system is currently doing:

Escape key (Esc)	This key returns the system to whatever it was doing before you selected the current option. Pressing this repeatedly will eventually return you to the main menu.
Function key 30 (Ctrl F10)	Holding down the **Ctrl** key and pressing **F10** will return the system to the main menu.

For example, if the screen was showing a plan display, successively pressing **Esc** would return you to the "Viewing a Prediction File" screen, then to the "Saved Predictions" screen, then to the main menu.

3. The Main Menu

There are seven options available at this point:

Generate new predictions: This option allows you to generate new predictions of your choice. It is selected by pressing the **F2** key.

View or recompute saved predictions: This option allows you to view, edit or recompute previously computed predictions. It is selected by pressing the **F4** key.

Edit terminal database: This option is used to manipulate (modify) the terminal database. It is selected by pressing the **F6** key.

Edit/Select frequency sets: This option is used to manipulate the frequency set database or to select a frequency set. It is selected by pressing the **F7** key.

Edit circuit database: This option is used to manipulate the circuit database. It is selected by pressing the **F8** key.

Edit/Select antenna sets: This option is used to manipulate the antenna set database or to select an antenna set. It is selected by pressing the **F9** key.

Quit: This option is used to exit from the system. It is invoked by pressing the **F10** key.

Note that you do *not* have to press the **enter** key, since the program is only expecting a one character response. This convention is maintained throughout the entire system:

- When one character responses are expected by the system, you need not press the **enter** key
- When longer responses (words, sentences) are expected, you must use the **enter** key to indicate the end of your input.

4. Generating Predictions

When you select this option from the main menu the "Enter Prediction Details" screen will appear and you can enter data about communications circuits.

4.1 Definition of Terms

Terminal: A Terminal is the name of some location on Earth, where a transmitter or receiver is located. It is usually associated with a geographic latitude and longitude, which define its position. An example of a terminal is Sydney, with a latitude of -33.87 degrees, and a longitude of 151.18 degrees.

Circuit: A Circuit is the name given to a path between a set of two terminals. For example, a circuit between Sydney and Darwin might be called "Sydney-Darwin".

Index: The Index, also known as the "Ionospheric Index", or the "T-index" is a number which describes the level of solar activity at a particular time. IPS provides these indices, which are derived from solar and ionospheric observations.

Circuit Type: The Circuit Type describes the characteristics of the path between two terminals. A prediction can be performed for three types of paths:

A Short Path: This represents the shorter great circle distance between two terminals. Most ordinary predictions are performed for this type of path.

A Long Path: This represents the longer great circle distance between two terminals. (It is equivalent to the Earth's circumference minus the length of the short path.)

A District Prediction: A district prediction is a prediction for all paths up to 300 km in length within a 300 km radius of the transmitter terminal.

Latitude:

The geographic latitude of a terminal is defined to be the number of degrees north or south of the equator:

- **A positive** latitude indicates a northern hemisphere location.
- **A negative** latitude indicates a southern hemisphere location.

Longitude:

The geographic longitude is defined to be the number of degrees east or west of the Greenwich Meridian. Positive longitudes refer to **east** and negative longitudes **west** of the meridian.

Bearing:

The bearing is the angle between true north and the receiver terminal, as measured from the transmitter terminal. It is always a positive angle between 0 and 360 degrees. (0 degrees is due north, with the angle increasing in a clockwise direction.)

4.2 Entering Prediction Details

Day:

This field is optional. It specifies the day of the month that lies in the middle of the period for which you wish to generate a prediction. Leaving this field blank is equivalent to specifying day 14, 15 or 16.

Month:

This input field requires you to enter the month for which you wish to generate the prediction.

You may enter:

- a number from 1 to 12
- or the first few letters which uniquely identify a month.

For example, you could type "jul", "7", or "july", for "July", but "ju" would be insufficient, since the program could not decide between "June" and "July".

Default input: If you do not enter *any* value for the month (i.e. if you just press the **enter** key when the input field is blank) the **present** month will appear in the input field.

Year:

This input field requires you to enter the year for which you wish to generate predictions. You may enter:

- a two digit year, such as "87", or
- a four digit year, such as "1987".

Default input: If you press the **enter** key when the input field is blank, the **present** year will appear in the input field.

Index:

This input field requires the appropriate ionospheric "T-index". The software has a database of historic monthly values of the "T-index", as well as a database of predicted "T-indices" for about 3 to 4 years into the future. The "T-index" for the date you have specified will appear in this field when the date fields are completed.

Should you have more up to date information concerning T-indices, or if you simply want to experiment and observe the effect of varying the "T-index", you may type any reasonable value into this field.

For optimum accuracy in your predictions you must keep the T-index database up to date (see "The TI Utility").

Circuit Name:

This field requires you to enter/select the name of the communications circuit. This name is the key by which it can be saved in and retrieved from the database. You may call a circuit anything you like, but it makes good sense to give a circuit a brief, descriptive name. For example, if the circuit is from Canberra to Perth, you may wish to call it "canberra-perth", or even "canb-perth".

When the cursor is in this field the lower half of the screen will show an alphabetically ordered list of the names of circuits stored in the database. The list will start at the first name *not alphabetically before* the input in the field. i.e. initially the list will start at the names beginning with "A" but if "S" is entered in the input field the list will change to start at the names beginning with "S" and so on. Thus you can see if the circuit you want is in the database. If so, by pressing the **F1** key you can transfer the "cursor" to this list, move it to the circuit you want and select it by pressing **Enter**. This is faster and more accurate than typing in the entire circuit name. The program will then fill in the remaining input fields from the database. Pressing **F1** instead of **enter** will return the cursor to the input field without filling the rest of the fields.

The circuit list can be reached wherever the cursor is by pressing the **F8** key.

If you enter a circuit name which does not yet exist in the database you will need to enter the associated terminal names in the appropriate fields. Then when you indicate you have finished specifying all the fields the circuit will be automatically saved in the database. If you don't wish this to happen, leave the circuit name field blank.

Entering Terminals:

When the cursor is in the transmitter (Tx) or receiver (Rx) name input fields a list of names of saved terminals will be displayed in the lower half of the screen. You can then enter or select a terminal name in the same manner as for circuit names.

Pressing **F6**, wherever the cursor is, during circuit specification will move the cursor to the list of terminal names. If the cursor was in any of the receiver terminal fields you can then select the receiver terminal otherwise the transmitter terminal can be selected.

Receiver Terminal:

There is an **alternative** way to specify the second (receiver) terminal. Rather than entering a terminal name and possibly geographic co-ordinates, you may, if you wish, specify a terminal by entering a distance and a bearing relative to the transmitter terminal. If you wish to do this, you will have to move the cursor to the appropriate input fields using the arrow keys, and then enter the desired distance and bearing.

Changing Input Fields:

At this stage, it is still possible to make corrections to information on the screen. You can move the cursor about with the arrow keys, and clear or re-type fields as desired.

When you are satisfied that all the information on your screen is as you want it, press the **F7** key to enter another circuit (you can generate predictions for more than one circuit at a time), or the **F9** key to do predictions and return to the main menu.

More Circuits:

After pressing **F7** the cursor will move to the start of the first input field (the day) and the circuit number will increase, but the data for the previous prediction will still be displayed in case this prediction is for the same date or circuit etc. Clear those fields you wish to change and type in the new data.

Calculating Predictions:

This will take from 5 seconds to over a minute per prediction depending on your computer. The predictions are automatically stored in a prediction file called "NONAME". If this file exists (from a previous prediction) you are given the option of renaming or overwriting it.

5. Saved Predictions

When you select this option from the main menu a list of the names of files containing predictions, the number of predictions each contains and the date they were created will be shown (see "Using Lists"). The following options are available:

View (Enter) This option allows you to view the contents of the currently selected prediction file in a number of ways. For further details see "Viewing a Prediction File".

Print (F9/F8/F6) This option allows you to print a GRAFEX, a frequency plan or an antenna suitability summary for all the predictions in the currently selected file. The output can be sent to the screen, a file or a printer. For further details see "Printing Reports".

Rename (F1) This option allows you to rename the currently selected file. You will be prompted to enter the new, up to 8 character name.

Copy (F3) This option allows you to copy the current file to a new file or to the end of an existing file. You will be prompted for the name of the destination file and can include a drive and path in the name if desired. If the destination file exists you can also select it from the list of files by pressing the F1 key, moving the cursor over the file name and pressing the Enter key.

Recompute (F4) This option allows you to recompute all the circuits in the current file for a particular date and T-index. The "Enter Prediction Details" screen will appear and you can enter the new parameters. For example, suppose you have a prediction file containing a variety of circuits for October, 1988. Should you wish to recompute these predictions for, say, November 1988, this option allows you to easily do so.

When you have entered the new date and/or T-index, press F9, and the software will recompute the predictions and store the result in the file "NONAME".

New Directory (F7) This option allow you to change the disk directory in which the system looks for saved prediction files. You will be prompted to enter the new path. This is useful, for instance, if you have copied prediction files to another disk.

You cannot change to a directory that does not contain any predictions. This does not change where the system puts new predictions i.e. the file "NONAME".

Erase (^F5) Holding down the Ctrl key and pressing F5 will delete the currently selected file.

5.1 Viewing a Prediction File

When viewing a prediction file the lower half of the screen will show a list of the names of all the circuits in the file and the cursor will be over the currently selected circuit. The data you entered for that circuit will appear in the upper half of the screen. By moving the cursor you can thus see all the initial details you entered for any circuit in the file.

The following options are available, however the plan and graph displays are only available on computers with a graphics card installed:

View (Enter) This option will display details of the actual prediction for the circuit. The display can be in text (i.e. a GRAFEX) or graphical form. Pressing the F1 key will swap between these two forms. For further details see the sections on "The GRAFEX Display" and "The Graph Display".

Plan (F7) This option will display in graphical format the recommended frequencies (from the currently selected frequency set) for communication over the current circuit. This allows users to plan their frequency usage. For further details see "The Plan Display".

If no frequency set is selected the system will first go to the frequency set screen to allow a set to be selected (see "The Frequency Set Database").

Print (F9/F8/F6) This option allows you to print a GRAFEX, a frequency plan or an antenna suitability summary for the currently selected prediction. The output can be sent to the screen, a file or a printer. For further details see "Printing Reports".

Copy (F3) This option allows you to copy an individual prediction to a new file or to the end of an existing prediction file. For further details see the "Copy" option under the section "Saved Predictions".

Erase (^F5) Holding down the Ctrl key and pressing F5 will delete the currently selected circuit from the file. If it was the only circuit in the file the file itself will be deleted and you will be returned to the list of prediction files screen.

6. The GRAFEX Display

This display is basically the same as the standard IPS GRAFEX prediction, with a few modifications to enable it to fit onto a standard text screen. It varies from the standard display, in that the section containing symbols has been "turned on its side". In this way, frequency is represented on the horizontal axis, and time on the vertical axis. See the "Glossary of Terms" for an explanation of abbreviations in the display.

Because of the size of the screen, only 12 hours of data fit onto it at once. To see the rest of the data

- Pressing ↓ scrolls the hours *up* the screen.
- Pressing ↑ scrolls the hours *down* the screen.
- Pressing **PgUp** or **PgDn** shows the 12 hours not on the screen.
- Pressing **F7** shows all 24 hours of the GRAFEX without the symbol key or circuit details. To return to the 12 hour GRAFEX press any key.
- Pressing **F8** shows the 5 frequencies (UD, MUF, OWF, EMUF, ALF) for each mode for all 24 hours. The GRAFEX symbols are not displayed. To return to the 12 hour GRAFEX press any key.

Scrolling Circuits: If you generate predictions for more than one circuit at a time, you will need to be able to view them selectively .

- Pressing → will display the next circuit in the current set of predictions
- Pressing ← will display the previous circuit in the current set of predictions

GRAFEX Symbols: The meanings of the 12 symbols used in GRAFEX predictions are displayed in the lower section of the screen.

7. The Graph Display

This display is a graphical form of the the standard IPS GRAFEX. It consists of a plot, for each mode, of frequency against time for UD, MUF, OWF, EMUF and ALF. In addition, if a frequency set is selected this will be plotted as a number of horizontal lines at the corresponding position on the frequency axis. The recommended frequency from the set is indicated by a thicker section of the line at the particular hour.

Scrolling Circuits: If you generate predictions for more than one circuit at a time, you will need to be able to view them selectively .

- Pressing → will display the next circuit in the current set of predictions.
- Pressing ← will display the previous circuit in the current set of predictions.

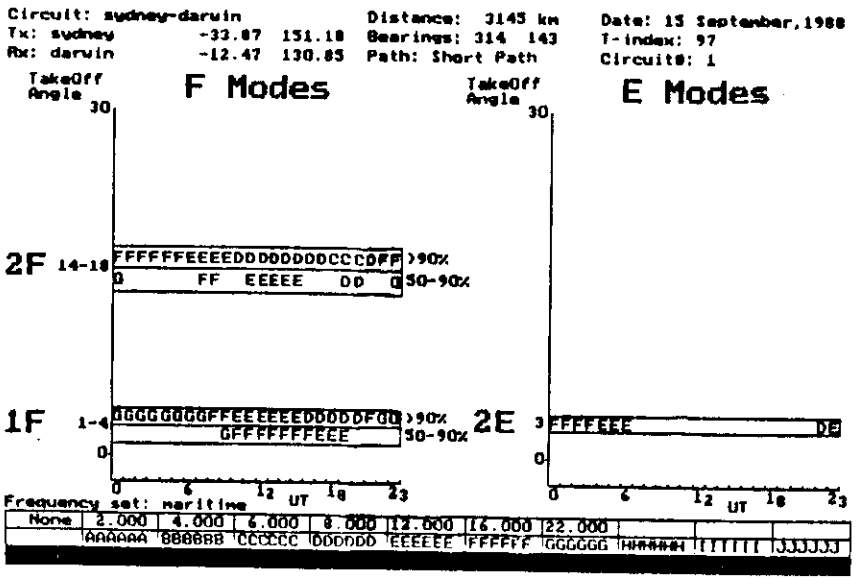
Frequency Set: You can select a frequency set by pressing **F7**. This will show the usual frequency set screen (see "The Frequency Set Database") and after you select a set will return you to this display.

8. The Plan Display

This display shows, in graphical format, a plan of recommended frequency usage. The recommended frequency from your frequency set for each propagation mode and for each hour is shown for two levels of probability of successful communication - greater than 90%, and 50 to 90%. The frequencies are plotted against takeoff angle to give a visual representation of the width of the takeoff angle range and the relative positions of these ranges for the various modes. Options available are the same as for "The Graph Display".

A sample display is shown below for the circuit "sydney-darwin" and the maritime frequency set on 15 September, 1988. For example, at 00 UT the recommended frequency for greater than 90% probability of successful communication via the IF mode (with takeoff angle range 1 to 4 degrees) is given by "G", which, according to the key at the bottom, corresponds to 22 MHz.

Figure 1. Example of The Plan Display



9. Printing Reports

It is possible to print 3 types of reports in a format suitable for hardcopy. They can relate to individual predictions or an entire file of predictions.

The 3 types of report can be prepared using the "Print GRAFEX/Plan/Antennas" option:

GRAFEX (F9)	Prints a GRAFEX frequency prediction.
Plan (F8)	Prints a frequency plan.
Antennas (F6)	Prints an antenna suitability summary.

See the following sections for examples of these reports.

After selecting one of the above options you have a choice of where to send the output.

To screen (F1)	The report can be previewed on the screen with this option.
To printer (F3)	This option sends the report to the printer.
To file (F5)	This option allows you to send the report to a file on disk. You will be prompted for a file name and can include a drive and path.

The frequency plan/antenna suitability options use the currently selected frequency set/antenna set. If no selection has been made the relevant screen to allow this will first be displayed (for further details see "The Frequency Set Database" or "The Antenna Database").

For information on printing a file of predictions or an individual prediction see "Saved Predictions" or "Viewing a Prediction File".

9.1 Sample GRAFEX Frequency Prediction Report

The following is an example of a GRAFEX report. For an explanation of the GRAFEX see the booklet "Understanding GRAFEX Frequency Predictions".

Figure 2. A GRAFEX Frequency Prediction Report

```
IPS GRAFEX HF FREQUENCY PREDICTIONS ---------- STAND ALONE PREDICTION SYSTEM

Circuit: sydney-darwin                Distance:  3148 km     Date: 15 September,1988
Tx: sydney          -33.87  151.19    Bearings: 314  143     T-index: 97
Rx: darwin          -12.47  130.85    Path: Short Path       Circuit#: 1

First Mode                                                                Second Mode
1F  1-4  1E  E    |---------F r e q u e n c y  (MHz)---------|    2F 14-18 2E  3
UT  DMF  MUF  ALF 1...5...10 ...15...20 ...25...30 ...35...40  DMF EMUF  ALF UT
00 28.5 33.4 13.5          B 888XXXMMMM MMFFFFFFFX% XXX....    18.9 16.1  9.2 00
01 28.7 33.3 14.0          A 888XXXMMMM MMFFFFFFFX% XXX....    18.8 16.9  9.6 01
02 28.8 32.5 14.3          A 8888XXXMMM MFFFFFFFFX% XX.....    18.5 17.2  9.8 02
03 28.8 31.6 14.4          A 8888XXXMMM MFFFFFFFXXX %....      17.8 17.1  9.9 03
04 27.8 30.5 14.2          A 8888XXMMMM FFFFFFXXXX% ....       17.8 16.7  9.8 04
05 25.6 30.8 13.7          A 888XXMMMMM FFFFFXXXX. ....        16.4 15.8  9.5 05
06 24.7 29.7 12.8         AB 88XXMMMMMM FFFFXXXXX. ....        16.4 14.4  9.8 06
07 24.1 29.8 11.5         SB 8XMMMMMMMF FFFFXXXX.. ...         15.9 12.2  8.3 07
08 23.5 28.3  9.8        ABMM MMMMMMMFF FFFXXXXX.. ..          14.6  7.1  6.9 08
09 20.6 26.2  0.0 MMMMMMMMMM MMMMMFFFF XXXXXX.... ..          13.4  0.0  0.0 09
10 17.3 23.3  0.0 MMMMMMMMMM MMMMFFXXX XXX.......            12.4  0.0  0.0 10
11 16.8 21.6  0.0 MMMMMMMMMM MMMMFXXXX %.......              11.9  0.0  0.0 11
12 15.5 20.9  0.0 MMMMMMMMMM MMMFXXXXX .......              11.3  0.0  0.0 12
13 15.3 20.6  0.0 MMMMMMMMMM MMMFFXXXXX .......             11.0  0.0  0.0 13
14 15.5 20.6  0.0 MMMMMMMMMM MMMFFXXXXX .......             10.9  0.0  0.0 14
15 14.8 19.7  0.0 MMMMMMMMMM MMMFXXXXX. ......              10.4  0.0  0.0 15
16 13.6 18.2  0.0 MMMMMMMMMM MMFXXXXX.. ....                9.8  0.0  0.0 16
17 11.8 16.3  0.0 MMMMMMMMMM MMXXXXX.... .                  9.0  0.0  0.0 17
18 10.1 14.1  0.0 MMMMMMMMMM XXXX....                       8.1  0.0  0.0 18
19  9.4 13.2  0.0 MMMMMMMMMX XXX....                        7.1  0.0  0.0 19
20 10.1 14.3  0.0 MMMMMMMMMF XXXX.....                      7.3  0.0  0.0 20
21 16.2 20.7  7.4        BMMM MMFFFFXXXX .....              10.4  0.0  6.1 21
22 24.4 28.7 10.9         AB8 XMMMMMMMMF FFFFXXXX.. ..      16.9 11.8  7.7 22
23 28.4 33.3 12.5          AB 8BXXMMMMMM MMFFFFFFFX% XXX.... 19.1 14.5  8.4 23
UT  DMF  MUF  ALF 1...5...10 ...15...20 ...25...30 ...35...40  DMF EMUF  ALF UT
```


9.2 Sample Frequency Plan Report

The following example shows the recommended frequencies from the maritime frequency set for communication from Sydney to Darwin on 15 September, 1988. For instance, 16 MHz is recommended for the time 00 to 06 UT for communication via the 2F mode with greater than 90% probability of success.

Figure 3. A Frequency Plan Report

```
IPS FREQUENCY PLAN PREDICTIONS ---------- STAND ALONE PREDICTION SYSTEM

Circuit: sydney-darwin                Distance:  3145 km     Date: 15 September,1988
Tx: sydney          -33.87  151.18    Bearings: 314  143     T-index: 97
Rx: darwin          -12.47  130.85    Path: Short Path       Circuit#: 1
Selected frequency set: maritime
  2.000  4.000  6.000  8.000 12.000 16.000 22.000

     Mode: 1F          TakeOff Angle: 1-4          | Mode: 1E  NONE
  Probability > 90%      Probability 50-90%        |

Time(UT) Frequency(MHz) | Time(UT) Frequency(MHz) | Time(UT) Frequency(MHz)
  00-06      22.000     |   00-09       None
  06-10      16.000     |   09-10      22.000
  10-14      12.000     |   10-17      16.000
  14-21       8.000     |   17-20      12.000
  21-22      16.000     |   20-24       None
  22-24      22.000     |

     Mode: 2F          TakeOff Angle:1-10          | Mode: 2E  TakeOff Angle:3
  Probability > 90%      Probability 50-90%        |

Time(UT) Frequency(MHz) | Time(UT) Frequency(MHz) | Time(UT) Frequency(MHz)
  00-04      16.000     |   00-01      22.000     |   00-04      16.000
  04-10      12.000     |   01-07       None      |   04-07      12.000
  10-18       8.000     |   07-09      16.000     |   07-22       None
  18-21       6.000     |   09-11       None      |   22-23       8.000
  21-22       8.000     |   11-16      12.000     |   23-24      12.000
  22-24      16.000     |   16-19       None      |
                        |   19-21       8.000     |
                        |   21-23       None      |
                        |   23-24      22.000     |
```

9.3 Sample Antenna Suitability Report

The following example of an antenna suitability report is for a set of 5 antennas with the name "TEST5" over a circuit from Sydney to Darwin. An antenna is recommended as suitable for use if its bearing and takeoff angle are both within 30 degrees of the bearing and takeoff angle for the circuit. The columns of the report have the meaning:

Antenna Id: The user's name for the antenna.

Type: The type of antenna.

Bearing: The bearing of the antenna. "OMNI" means an omni-directional antenna. The numbers in brackets are the difference between the circuit's bearing - shown immediately beneath the column title - and the antenna's bearing. The antennas appear in increasing order of the size of this bearing difference.

Takeoff: The takeoff angle for the antenna.

Takeoff Difference: This contains a column for each possible mode. Numbers in the columns are the difference between the takeoff angle for the mode - shown immediately beneath the name of the mode - and the takeoff angle for the antenna. If the two takeoff angles coincide then "OK" will appear in the column.

In this example only the antenna "tx1" is recommended for use. This is an omni-directional antenna and its 45 degree takeoff angle is 27 degrees from the required takeoff angle for propagation via the 2F mode. The other antennas all have bearings more than 30 degrees from the circuit bearing of 314 degrees and "tx3" also has too high a takeoff angle.

Figure 4. An Antenna Suitability Report

```
IPS ANTENNA SELECTION ---------- STAND ALONE PREDICTION SYSTEM
Circuit: sydney-darwin          Distance:  3148 km    Date: 15 September,1988
Tx: sydney      -33.87  151.18  Bearings: 314  143    T-index: 97
Rx: darwin      -12.47  130.85  Path: Short Path       Circuits: 1
Antenna site: TEST5   Heading: 0

                                                      Takeoff Difference
Antenna Id          Type        Bearing    Takeoff    1F    2F    2E
                                  314                 1-4  14-18   3
tx1                 whip          OMNI        45                27
tx4                 wire       278( -44)      34
tx5                 hipa        25( +71)       5
tx2                 dipole      98(+136)      45
tx3                 dipole     128(+166)      58
```


10. The Terminal Database

The system maintains a database of terminals so you do not have to enter latitudes and longitudes for every prediction. You can modify this database by choosing the "Edit terminal database" option of the main menu. The display will then show the "Enter Prediction Details" screen and you will be able to enter or edit data in the transmitter terminal input fields i.e. name, latitude and longitude.

Adding Terminals: To add a terminal to the database, type in a name for it and its geographic latitude and longitude. Press the F7 key to store your input in the database.

Deleting Terminals: To delete a terminal, move the cursor to the list of terminal names and then over the name of the terminal to delete. Press the F5 key while holding the Ctrl key down and the terminal will be removed from the database.

Editing Terminals: To edit a terminal, move the cursor over the name of the terminal and press Enter. The data for the terminal will be displayed in the corresponding input fields. Edit them as desired and press the F7 key.

If you have changed the name of the terminal the data will be stored in the database under the new name. The original terminal will be unaffected.

11. The Circuit Database

The system maintains a database of circuits to allow a communications path to be easily specified by a user-given name. You can modify this database by choosing the "Edit circuit database" option of the main menu. Working with the circuits database is staightforward and practically the same as working with the terminal database. Therefore, if you need more detail read through the preceding section on "The Terminal Database".

12. The Frequency Set Database

The system maintains a database of frequency sets to allow easy specification of a user's frequency assignments for frequency management planning. Each frequency set consists of a user-given name and 1 to 10 frequencies. Frequencies are in megahertz with 3 decimal point precision i.e. to the nearest kilohertz.

You can modify the frequency set database or select a frequency set for making predictions by choosing the

- "Edit/Select frequency sets" option of the main menu,
- "Select frequency set" option at the "Plan" screen,
- "Frequency set" option at the "Graph" screen.

You can add, edit or delete frequency sets just like terminals or circuits. For more detailed instructions on this see the section on "The Terminal Database".

12.1 Selecting a Frequency Set

To select a frequency set for subsequent calculations, move the cursor over the name of the desired frequency set or enter a new set if required and press the **F9** key. The set will be selected and you will exit from the current screen. To select no set, press the **F9** key when the cursor is in an input field (rather than the list of set names) and if the input fields are blank no set will be selected.

If you type in a new frequency set and press the **F9** key to select it, it will automatically be added to the database.

13. The Antenna Database

For users with a choice of antennas the antenna database enables the system to calculate the suitability of the antennas for a particular circuit. Each antenna set can be stored in a user-named file. Each antenna in a set consists of four fields. These are

Name: This field is a name by which the antenna can be identified, e.g. "antenna1",

Type: This field is optional and contains the type of the antenna, e.g. whip, dipole, etc,

Bearing: This field is the directional bearing of the antenna. For an omni-directional antenna leave this field blank,

Takeoff: This field is the angle of elevation or takeoff angle of the signal from the antenna. For a constant gain antenna leaves this field blank.

To modify the database or select an antenna set for calculations, choose the "Edit/Select antenna" option in the main menu. The screen will show a list of names of antenna sets or if there are none you will be prompted for the name of one to create. Several of the options available are identical to options for prediction files (see the section "Saved Predictions"). These are

- Rename.
- Copy.
- Delete.

Other options are

Creating a set of antennas: To add a set of antennas to the database, press the **F9** key and enter your name for the set. The screen will then change to the antenna specification screen (see next section).

Selecting a set of antennas: To select a set of antennas, move the cursor to the name of the desired set and press the **F9** key. This will select the set and return you to the previous screen.

Modifying a set of antennas: To view or edit a set, move the cursor over its name in the list and press the **Enter** key. The screen will then change to the antenna specification screen (see below).

Heading: If a set of antennas is on a moving platform such as a ship the bearing of each antenna is given relative to the platform i.e. it is the true bearing when the platform is heading due north. This option allows you to specify the platform's heading so the antenna's true bearing can be calculated.

13.1 Antenna Specification

When you select this option the upper half of the screen will show the various input fields that specify an individual antenna and the lower half will show a list of names of antennas in this set. You can move the cursor to this list by pressing the **F1** key and the full details of the antenna under the cursor will appear in the input fields. You can add, edit or delete individual antennas in the same manner as terminals. For further details, see the section on "The Terminal Database".

14. The TI Utility

The TI utility is a separate program for updating the T-index database. The latest information on the T-index is published by IPS in its monthly "SOLAR GEOPHYSICAL SUMMARY".

The program displays on the screen the monthly T-indices for 21 years from the database. This database starts at 1938 and currently has values up to 1990. Initially the cursor will be at the last value in the database.

left arrow key (←)	This key moves the cursor to the *previous* month.
right arrow key (→)	This key moves the cursor to the *next* month.
down arrow key (↓)	This key moves the cursor to the *next* year.
up arrow key (↑)	This key moves the cursor to the *previous* year.
end key (End)	This key moves the cursor to the *last* month on the screen.
home key (Home)	This key moves the cursor to the *first* month on the screen.
page up key (PgUp)	This key shows the previous page of the database i.e. the preceding 21 years.
page down key (PgDn)	This key shows the next page of the database i.e. the next 21 years.
delete key (Del)	This key deletes the character on top of the cursor.
Function key 5 (F5)	This key clears the value at the cursor.
escape key (Esc)	This key cancels any recent changes made to the current value.
enter key (Enter)	This key indicates the end of input and moves the cursor to the next month.

To change the T-index at the cursor simply clear the old value (if any) and type in the new one.

To exit from the program, press the **F2** key. You then have the option of saving any changes (the **Enter** key) or quitting without saving (the **Esc** key).

15. Special Keys

This section describes the functions of some of the special keys on the keyboard. If you are familiar with the computer keyboard, you should ignore this section.

Enter key — The **enter** key (sometimes known as the **return** key) is used to indicate the end of a line of typing. For example, if you are instructed to enter the name "adelaide", you have to type each character in the word "adelaide", and then press the **enter** key.

Backspace key — The **backspace** key, (usually located above the **enter** key) is used to erase characters. Pressing the **backspace** key (which is sometimes labelled with the letters **bs** or with a '←'), erases the last character typed, and moves the cursor left by one character position.

Shift key — The **shift** key is used to type capital letters (upper case characters) on the screen. For example, if you press the "A" key on the keyboard, an "a" (lower case) will appear on the screen. If you want an "A" (upper case) to appear, you also have to press the **shift** key. That is, press the **shift** key down *first*, and then, while holding it down, press the "a" key. This will cause an upper case "A" to appear.

arrow keys — The **arrow keys** (sometimes found on the numeric keypad) are application dependent. This means, that it is up to the software to interpret them. In the Stand Alone Prediction System, the arrow keys move the cursor between as well as within the "input fields".

- The left and right arrow keys move the cursor to the left and right within an input field.
- The down arrow key moves the cursor from the current input field to the next input field.
- The up arrow key moves the cursor from the current input field to the previous input field.

Function keys — The **function keys** are also application dependent. For a description of their usage, refer to earlier sections of the manual.

16. Glossary of Terms

ALF: The *Absorption Limiting Frequency* is the lowest usable frequency for a particular communication path and time.

Circuit: A *circuit* is a path between a set of two terminals (locations). The Stand Alone Prediction System has an extensive database of stored circuits.

Circuit Type: The *circuit type* refers to the "characteristic" of the path between two terminals. There are three types of circuits. The first is the *short path*, which represents the shorter great circle distance between two terminals. The second is the *long path*, which is the longer great circle distance between two terminals. The long path distance is equal to the Earth's circumference minus the length of the short path. The third circuit type is the *district prediction*. It is a prediction for a single terminal (location), and is valid for all paths up to 300 km in length within a radius of 300 km from that terminal.

Database: A *database* is a store of relevant data items, arranged in an easily accessible and modifiable structure. In the Stand Alone Prediction System, the database contains an extensive list of terminals, circuits as well as selected computed predictions, frequency sets, and antenna arrays.

District Prediction: A *district prediction* is a prediction which is valid for all paths within a 300 km radius around a single terminal and up to 300 km in length. See *Circuit Type*.

EMUF: The *E-layer Maximum Usable Frequency* (see "MUF").

Frequency Set: A *frequency set* is a number of frequencies allocated to a particular user by the Dept of Transport and Communications.

GRAFEX: *GRAFEX* is the name given to the main output format of the prediction system. For further explanation of the GRAFEX format, please refer to the IPS booklet, "Understanding GRAFEX Frequency Predictions", or the IPS publication "An Introduction to IPS Radio and Space Services, July 1988" and "Radio Propagation Services: Explanatory Leaflet No.1 - June 1988".

Input Field: An *input field* is that part of an input screen, following a ":" character, which accepts input from the user. End of input is indicated by pressing the **enter** key.

Input Screen: An *input screen* is a screen through which a user may enter data. It consists of a number of input fields.

Long Path: A *long path* is a particular type of circuit. See the definition for "circuit type" for a more detailed explanation.

MUF: The *Maximum Usable Frequency* is that frequency with a 50% probability of success for a particular path and time.

OWF: The *Optimum Working Frequency* is that frequency with a 90% probability of success for a particular path and time.

Short Path: A *short path* is a particular type of circuit. See the definition for "circuit type" for a more detailed explanation.

Takeoff Angle: The *takeoff angle* is the angle of elevation of a signal from an antenna. Only a limited range of takeoff angles for a circuit and mode will give a signal at the receiver.

Terminal: A *terminal* is a location on earth where a transmitter or a receiver is located. It is defined by a user-given name and a pair of geographic co-ordinates which give its position.

T-index: The *T-index* is a number characterising the level of solar activity for a particular month. It is calculated by IPS Radio and Space Services, and is based on solar and ionospheric observations.

UD: The *Upper Decile* frequency is that frequency with a 10% likelihood of successful reception for a particular path and time.

17. Database Restrictions

There are a number of restrictions placed on the databases due to memory limitations.

These are:

- maximum number of

terminals	2000
circuits	1000
frequency sets	50
antenna sets/directory	250
antennas/set	50
prediction files/directory	250

- maximum characters in names of

terminals	25
circuits	20
frequency sets	25
antenna sets	8
antennas	25
antenna types	10
prediction files	8

- decimal points for

latitude	2
longitude	2
frequency sets	3
predicted frequencies	1

18. User Support Information

Software Support:

For software support, please contact:

IPS Radio and Space Services
PO Box 702
DARLINGHURST NSW 2010
AUSTRALIA
Telephone: (02) 269-8623.

You may also correspond by electronic mail (via ACSnet) by addressing queries to:

ras@ipso.oz