

ES-PROP
Sporadic-E Propagation Analysis
version 1.4 - November 1994
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INTRODUCTION

ES-PROP is a graphic sporadic-E analysis program that permits the analysis of E_s MUF's and paths. The user inputs observed frequency and path endpoints. The program calculates the MUF for the maximum E_s path length (which is typically 2300 km for a E_s cloud height of 105 km.) The program also displays, on a map, the path of the observed endpoints, the calculated location of the E_s cloud (the control point) and the loci of minimum distances around the control point for operating frequencies within the VHF amateur bands. The program will also attempt to analyze a 2-hop sporadic-E path. The program will also predict a target endpoint for a given control point and path starting point.

Path endpoints are generally entered as Maidenhead grid squares (4 or 6 characters). Endpoints may be entered manually or with a mouse. When using a mouse, the current grid square (and geographic coordinates) of the mouse cursor is displayed on the screen to allow accurate placement of the path endpoints.

ES-PROP is based on the article: Emil Pocock, "Sporadic-E Propagation at VHF: A Review of Progress and Prospects", QST, April 1988. Version 1.4 corrects problems with the calculation of the maximum single-hop distance MUF that exists in earlier versions of ES-PROP. Earlier versions calculated a much higher MUF that can exist. Thanks to Pat Dyer, WA5IYX, for pointing out the problem.

The program ES-PROP is copyrighted with all rights reserved by the author. However, ES-PROP, version 1.4 may be freely used. The program may also freely distributed as long as no profits are realized.

SYSTEM REQUIREMENTS

An IBM compatible computer with at least an EGA display card and RGB monitor is required. A mouse is required for full functionality. A math coprocessor is also recommended.

STARTING THE PROGRAM

The following files are required ES-PROP, version 1.4:

ES-PROP.EXE	the executable program
MAP.ESP	map file

Generally, the program files should be in the same sub-directory. To start the program, change directory to the appropriate sub-directory and enter:

```
es-prop <CR>
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The program will load and display the map with the file name "MAP.ESP". ES-PROP supports screen mode 8 (640 X 200) and screen mode 9 (640 X 350). The type of screen mode used depends is determined by the map file. Generally one of the distributed map files will be copied into "MAP.ESP."

3.3.1 The distributed mapfiles (except for MAP.ESP) have base file names that end with either an 8 or 9. Files with the numeral 8 are screen mode 8 map files and files with the numeral 9 are files for screen mode 9. Screen mode 8 is used for older systems with only an EGA display card and a RGB monitor.)

3.3.2 Map files, other than the default MAP.ESP, may be selected from the command line by entering, for example:

```
es-prop USAMAP9.ESP <CR>
```

The program will detect the presence of a mouse. If a mouse is detected, the program will display the map and a mouse cursor will be present. The upper-left hand corner will display the geographic location and grid square for the location pointed to by the mouse cursor. If a mouse is not detected, the program will start and prompt for the manual input of the first path endpoint.

USING THE PROGRAM

Definitions

Entry screen (mode)

The screen where a mouse cursor is displayed in the entry screen and the geographic location and grid square of the mouse cursor is displayed above the map.

Options screen (mode)

The screen in which options such as clearing the map, eliminating iso-MUF lines and changing the virtual height of the E_s are available form this screen.

Endpoint setting mode

The mode where path endpoints and observed MUF are entered. See paragraph .

The program displays on screen prompts and information to help use the features of the program.

The program displays two different basic screen types, an *options screen* and an *entry screen*.

The left portion of the top line of the *options screen* appears as:

Quit Eliminate iso-MUF Clear map Predict path +/- h'

See section .

The left portion of the top line of the *entry screen* displays the geographic location and grid square of the location pointed to by the mouse cursor. If a mouse is not detected, then the left portion of the top line is blank. See section .

The program starts in the *entry screen* if a mouse is present. If a mouse is not present, the program will start in the *endpoint setting mode* (see section .)

Entry Screen with Mouse

Quitting the program

To quit the program, type "q".

Switching Screens

To switch to the information screen, type "<Esc>".

Mouse Buttons

The right mouse button is used to enter the path *endpoint setting mode* (see paragraph .) When in the path *endpoint setting mode*, the right mouse button will cancel the operation and return the *entry screen* (see paragraph .)

The left mouse button is used to enter a geographic location. When pointing to a control point location, the clicking the left mouse button will return MUF information of the selected point. When in the path endpoint setting mode, the left mouse button will set the ends of the observed path and allow entry of the observed frequency.

Entering Observed Path Information

The current location of the mouse is displayed on the top line. To

enter the endpoints of an observed propagation path, click the right mouse button. The geographic information on the top line is cleared and a prompt for the first grid square appears below the map. The prompt line shows the grid square location of the mouse cursor. Point the mouse to the desired location and then click the left mouse button. A prompt appears for the second grid square. Select the second endpoint with the left mouse button. A prompt to enter the observed frequency appears along with two lines containing frequency input prompts. The upper line is a frequency line between 25 and 300 Mhz with the locations of the FM and low VHF TV bands and the 6, 2 and $\frac{3}{4}$ meter bands identified. The lower line displays 50, 144 and 222 MHz. The observed frequency band can be selected by pointing to the appropriate frequency band on the lower line and selecting it with the left mouse button or it can be selected by pointing to the appropriate frequency on the upper line. When the cursor is pointing to the upper line, the frequency that the cursor is pointing to appears to the left. Select the desired frequency by clicking the left mouse button. When the mouse cursor is removed from the upper line, the indicated frequency disappears.

The MUF for the maximum distance single-hop path is calculated and displayed below the map. The calculated MUF will be less than or equal to the actual MUF depending on whether the observed path for the observed frequency was the minimum distance that the level of E-layer ionization could support. The great circle path between the two endpoints is drawn on the map. The loci of points that are one-half the possible path length at the MUF (iso-MUF's) from the control point for a given virtual height of the E_s is drawn on the map. Finally the iso-MUF's for the approximate minimum distances from the control point at operating frequencies of 50, 144 and 222 MHz are drawn; the program assumes that the minimum path length was entered for the observed frequency. After the map has been updated, the program displays the *options screen*. To return to the *entry screen*, press any key that is not an option (such as the space bar) or click the left mouse button.

To abort the *endpoint setting mode* press either the right mouse button or press "<Esc>".

Manually Entering Path Information

The path endpoints and frequency of observation can be manually entered by pressing any key while in the entry screen mode. (If in the path endpoint setting mode, press "<Esc>" to exit and then

press any key.

Prompts for path endpoints and observed frequency will appear. Map information will be drawn as described in paragraph .

To abort manual entry, do not enter any path endpoint grid square information and press <Enter>.

Endpoint Setting without Mouse

If a mouse is not detected upon program startup, the program starts in the *endpoint setting mode*. See paragraph .

The Predict Path option will not be available from the *options screen*.

Showing Information about a Control Point

Pointing to a control point and pressing the left mouse button will display the MUF for the control point. If the distance loci lines have been eliminated, then the lines will be redrawn. The mouse cursor must be within 300 km of the control point when the left button is pressed and the closest control point will be selected. Information for 25 control points can be stored.

Options Screen

The following options are available from the options screen:

Quit the program - press "q".

Eliminate iso-MUF - press "e". The map is cleared of the iso-MUF's, however the control point locations are still displayed.

Clear map - press "c". The map is cleared and all control point data is cleared.

Predict path - press "p". See paragraph .

+/- h' - press "+" or "-" to change the virtual height of the E_s cloud. Heights of 95, 100, 105, 110 and 115 km can be selected. The default virtual height is 105 km. The current virtual height that the program is using is displayed in the upper righthand corner of the display. If a control point is entered at a given virtual height and the virtual height is changed, then when information about the control point is redisplayed (see paragraph), the distance loci drawn on the map reflect the new virtual height.

Switching to the *entry screen*

The *entry screen* is entered by pressing any key other than one of keys used for the options, i.e., for example, the space-bar.

Predicting paths

The endpoint grid squares for different paths for a selected control point can be determined.

Press "p" from the options screen. "Select point" appears in the upper righthand corner of the display.

Point to the desired control point with the mouse cursor and press the left mouse button. If the distance loci have been eliminated, then they will be redrawn. The "Select point" prompt will clear and the grid square and geographic location pointed to by the mouse cursor will be displayed in the upper righthand corner of the display.

Point to the desired starting path endpoint and press the left mouse button. The great circle path will be drawn and the two endpoint grid squares will be displayed.

ASSUMPTIONS

This program makes a number of assumptions. MUF and distance calculations are made assuming that there is a flat ionosphere over a flat earth. Single E_s cloud paths are also assumed. A number of other assumptions have been made in trying to characterize paths other than single hop.