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User's Guide to AGARIS: Advanced GAng RIp Simulator

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Abstract

AGARIS (Advanced GAng Rip Simulator) is a computer program available for IBM compatible personal computers with 80286 and higher processors that simulates the gang ripping of lumber and allows the user to perform "what if" types of analysis. The program simulates fixed-arbor and floating outer blade gang ripping. Its user-friendly format allows easy changing of variables. Gang-ripped boards are easily viewed and printed. Data for individual boards and all boards (summaries) are available based on surface area or piece counts.

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1. Introduction

AGARIS (Advanced GAng RIp Simulator) is a Fortran 77 program that simulates lumber gang-rip-first operations using digitized board data files. Each data file contains several boards. The dimensions and defects of each board are stored as a series of coordinates. For each board, AGARIS determines an optimal cutting solution based on full width, primary cuttings. The simulation operates on one board at a time. First, each board is gang-ripped. The strips are then crosscut into primary parts. Any remaining board segments are examined for salvage parts that can be obtained by additional rips and, if needed, crosscuts.

AGARIS is the latest in a series of gang-rip first simulators developed by the USDA Forest Service. The base program, RIPYLD(Stern and McDonald 1978), and its unpublished successor, MULRIP, were developed at the Forest Products Laboratory, Madison, Wisconsin. GR-1ST(Hoff et al. 1991) , developed at the Forestry Sciences Laboratory, Princeton, West Virginia, added movable outer blade and fixed-arbor processing among other options and emphasized yield comparisons based on primary lengths.

AGARIS features a menu-driven, user-friendly option setup program. The setup program allows you to easily create and change cutting options. The program will detect and prompt you to correct errors in the options before board analysis begins. After all the boards in the data file have been analyzed, a summary program will be run automatically. This program gives the user a chance to view or print the parts listings and summary tables. The user may graph the boards and their cutting solutions on the screen or printer. The board plot and summary files are retained after each run. These can be viewed or plotted at a later time.

Besides the user-friendly interface, AGARIS features enhanced internal algorithms. These include a robust salvage determination algorithm and summary reports. The new salvage algorithm favors shorter, wider parts over longer, narrower parts. The summary reports now include user-defined width groupings and, for random length studies, length groupings. This allows the user to see the total number of parts, their area, and percentage of total area by any desired width and length combination.

AGARIS requires the following to run properly:

1. An IBM AT, 386, or 486 computer or 100 percent compatible.[1]
2. 512K of Random Access Memory (RAM).
3. A hard disk with at least 2.5 Mb in free space.
4. MS DOS 4.0 or later (MS DOS is a trademark of Microsoft Corp.).
5. A high-density 3.5-inch or 5.25-inch floppy drive.
6. An EGA or VGA graphics display.
7. A printer (optional).

An expanded gang-rip-first simulator will be available in 1995. This program will feature an entirely new set of sawing algorithms. There will be more widths, more saw spacings, and different arbor setups to more closely simulate industrial practice.

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[1] The use of trade, firm, or corporation names in this publication is for the information and convenience of the reader. Such use does not constitute an official endorsement or approval by the U.S. Department of Agriculture or the Forest Service of any product or service to the exclusion of others that may be suitable.

2. Installation

The distribution diskette contains an installation program for the AGARIS programs and data from the "1992 Data Bank for Red Oak Lumber"(Gatchell et al. 1992). The lumber is graded according to 1990 NHLA rules(Natl. Hardwood Lumber Assoc.). This program copies the compressed files containing the programs and data to the destination drive and directory. Next, these files are automatically decompressed and the original compressed files removed. You are notified of any problem that arises during installation.

The following steps cover the installation of AGARIS onto your hard disk drive. After performing these steps you are ready to run AGARIS from the MS DOS prompt.

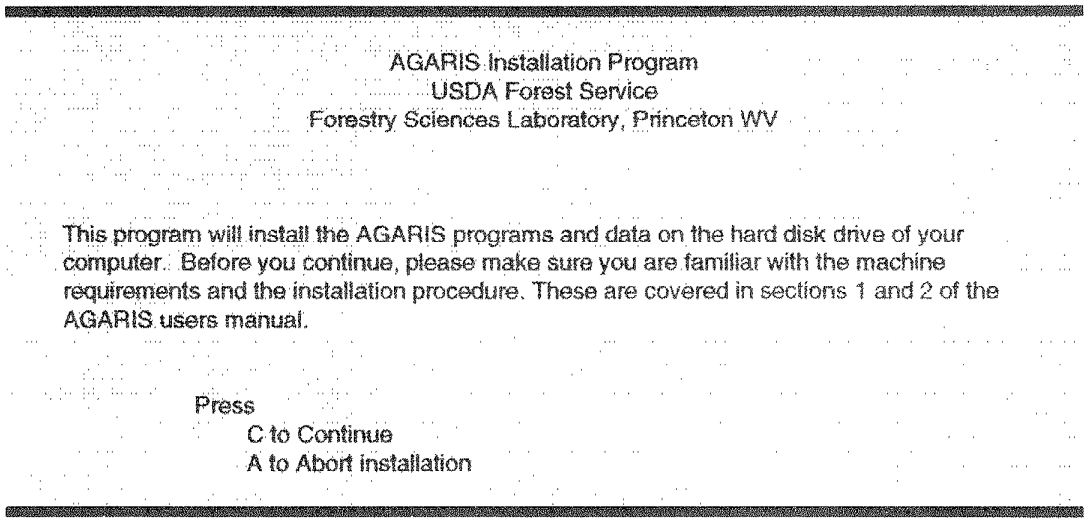

Figure 2.1. Installation program initial screen.

2.1 Running Install Program

To begin the installation, place the distribution diskette in the floppy drive. Next, make the floppy drive containing the distribution diskette the working drive. At the DOS prompt, type the letter identifying the floppy drive and a colon. Then press Return. On most computers, the floppy drive is A: or B:. For this example we are using drive A:. At the DOS prompt, we enter:

A:

Then, to run the install program, type:

AGARINST

at the DOS prompt and press Return. When the install program begins running, the initial screen shown in Figure 2.1 will appear. Press the "C" key to continue with the installation, or "A" to abort.

NOTE: If your computer has a CD-ROM drive without a CD in it, a problem may result during the initialization of the install program. On some machines a "Drive XX not ready error" will occur. If this happens, press F to fail the CD-ROM drive access and allow the install to proceed normally. The occurrence of this error will not affect the installation to any of your hard disks.

2.2 Confirming Install Destination

The next screen (Fig. 2.2) shows the drive and subdirectory on which the AGARIS programs and data will be installed. The default location is drive C:, in subdirectory \AGARIS. If this location is acceptable, press the "C" key to continue and proceed to step 2.4. If you do not want to continue with the installation, press the "A" key to abort. If you would like to install AGARIS to another drive or directory, press "M" to modify the destination and proceed to step 2.3.

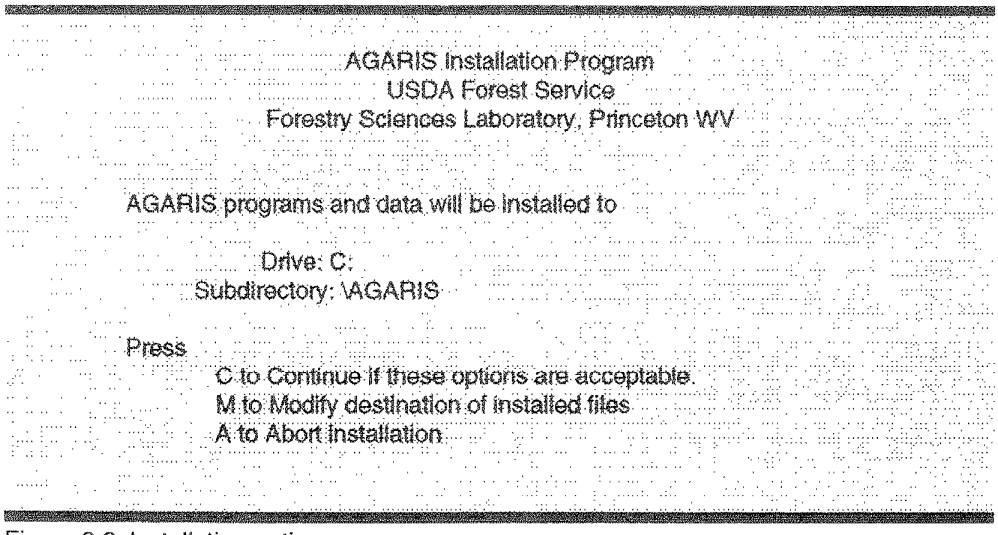

Figure 2.2. Installation options screen.

2.3 Modifying Install Destination

This step allows you to customize the installation of AGARIS. You are first presented with a choice of destination drives. The install program first checks the computer system to determine the valid choices for hard disks. These are displayed on the screen. Enter the number of the drive on which you want to install AGARIS.

After selecting the destination drive, you are prompted to enter the name of the destination subdirectory. This subdirectory can be a new subdirectory or an existing one. When entering the name of a subdirectory, give the complete path of the subdirectory starting with the root directory. For example, to install AGARIS in the subdirectory \YLDSTUDY\AGARIS, enter at the destination subdirectory prompt.

\YLDSTUDY\AGARIS

Figure 2.3 is the modification screen showing these example entries. After you have entered your choice, the computer will display the screen shown in Figure 2.2, with the modified destination subdirectory. Now, refer back to the instructions for step 2.2, for an explanation of how to continue.

AGARIS Installation Program
USDA Forest Service
Forestry Sciences Laboratory, Princeton WV

AGARIS Custom Installation

A check of your system indicates the following drives:

1. C: 2. D: 3. E: 4. F:

Enter number identifying destination drive: 1

Enter the name of the destination subdirectory: \YLDSTUDY\AGARIS

Figure 2.3. Customize install destination.

2.4 Installing and Decompressing Distribution Files

This step performs in-depth error checking as it copies and decompresses the files from the distribution diskette. The install program keeps you informed as to which task it is currently performing. The first step is the creation of the destination subdirectory. Several errors can occur during this step. The error message "Invalid or non-existent drive selected." will cause the installation program to abort. This error will occur if you have tried to use the source drive as a destination drive, or if you have selected a nonexistent drive. A related error message, "Unable to create destination subdirectory.", occurs when you have entered an invalid pathname for the destination subdirectory. The message "Destination subdirectory already exists, continue? (Y/N):" is displayed only when you have selected a preexisting destination subdirectory. If you answer "Y", AGARIS will be installed to the selected subdirectory. The installation will not delete existing files in the subdirectory. If you answer "N", the installation will halt.

2.5 Configuring Your System

The CONFIG.SYS file defines devices and run time parameters for your personal computer system. When installation is complete you should check to see that your CONFIG.SYS file includes the following lines:

```
FILES = 20
BUFFERS = 20
DEVICE = C:\DOS\ANSI.SYS
```

The sequence, location, and spacing of the lines are not important. It is only important that the values for the FILES and BUFFERS settings are at least 20. If the settings are less than 20, you must edit the CONFIG.SYS file and correct the settings. The DEVICE = C:\DOS\ANSI.SYS line must be present to allow AGARIS to properly display the system menus and screens. The exact location of ANSI.SYS may vary from system to system. The example shown here uses the most common location. Once you have finished editing, you must re-boot your computer. Revised CONFIG.SYS parameters will not take effect until this is done.

If you will be plotting the processed board on a laser or color printer, please refer to Appendix III, which contains instructions on configuring AGARIS for use with your printer.

3. Running AGARIS

To run AGARIS, the working directory must be the subdirectory that contains the AGARIS programs and data. If you installed the software without modifying the destination. this subdirectory is C:\AGARIS. To make this directory the working directory, enter the following command at the DOS prompt:

CD \AGARIS

To run the AGARIS program, enter the following command at the DOS prompt:

AGARIS

This command runs a batch file that executes the AGARIS setup and gang- rip programs. AGARIS will first display the version screen shown in Figure 3.1. After you have read the screen, press any key to continue.

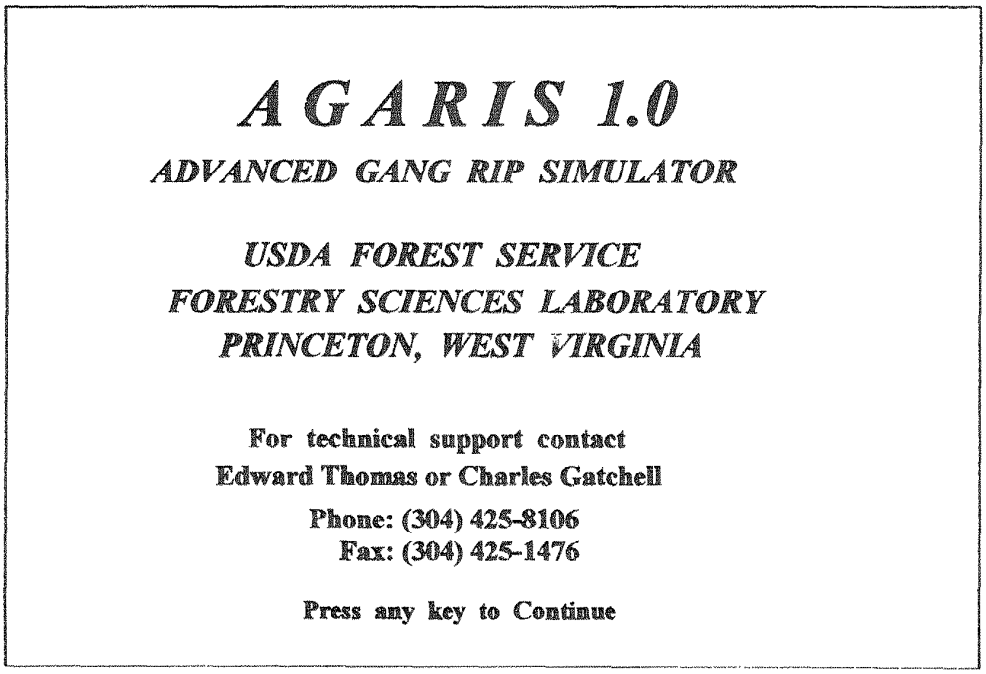

Figure 3.1. AGARIS version screen.

AGARIS will then ask two questions concerning the output options for this run. A sample run showing the screen that asks these questions is shown in Figure 3.2. To answer, enter "Y" for yes or "N" for no. The first question is "Do you want parts yield information by board? (Y/N)." If information on parts yield by board is selected, you will be presented with a detailed list of primary and salvage cuttings for each board and the accumulated primary and salvage part yields for all boards. You also will be shown total primary and secondary cuttings areas for each board. The second question is "Do you want summary tables for all processed boards? (Y/N)." Enter "Y" to this question to generate summary

tables for this run. The summary tables show the amount of primary and secondary parts in each width and length group. You also are provided with the total surface area in primary and salvage parts for each width and length.

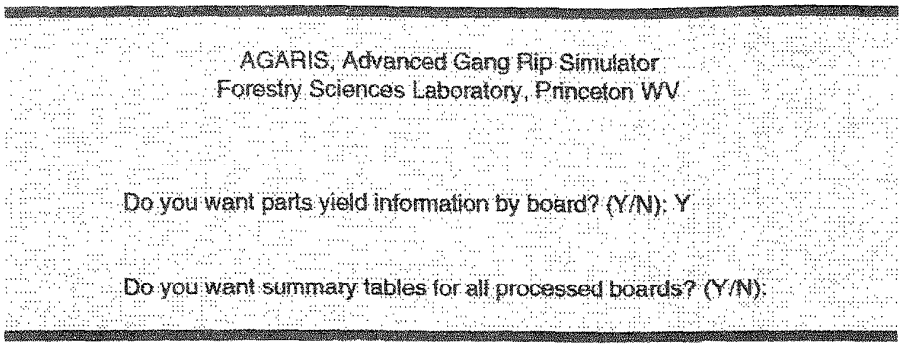

Figure 3.2. AGARIS startup options screen.

After you have answered the two initial option questions, the runtime options display screen will appear (Fig. 3.3). This screen displays the chosen options for the current AGARIS run. The setup options are contained in the file SETUP.AGR. A sample SETUP.AGR file was installed with the AGARIS system. Should the SETUP.AGR file be deleted accidently, AGARIS will immediately have you begin creating the setup options list shown in Section 4.

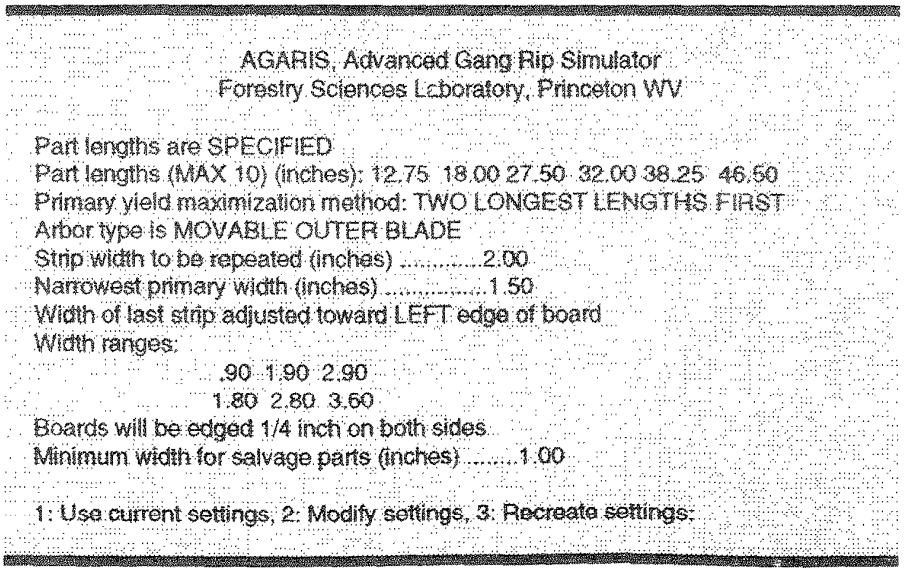

Figure 3.3. Initial options display screen.

The options display screen in Figure 3.3 offers three choices: 1) start the AGARIS run using the displayed options; 2) modify the current options list; 3) create a new options list. To select an item, enter the selected choice number and press return. Section 4 is concerned with the creation of a new options list. Section 5 deals with the modification of the current options list. If you are running the AGARIS system with the displayed options, refer to Sections 6 and 7, which cover the selection of a data file and analysis of AGARIS results.

4. Creating New Options List

When creating an options list, AGARIS asks a series of interrelated questions. Succeeding questions depend on your responses. In several instances, the program sets several parameters following the response to a single question.

4.1 Options List Creation Rules

IMPORTANT: All measurements are to be entered in inches and to the nearest 0.25 inch unless otherwise indicated.

If a mistake is made while entering the options, make a note of the error and correct it after all the options have been entered. Select "2" from the options summary screens shown in Figure 3.3 or 4.12 and make the corrections. For help in making the modifications refer to Section 5.

The remainder of this section takes you through the steps involved in creating a new setup options list. To create the options list displayed in Figures 3.3 and 4.12, follow steps 4.2, 4.2A, 4.3, 4.4, 4.8, and 4.9. For each step enter the settings that are given as an example.

4.2. Cutting Length Type Selection

The first question concerns cutting lengths. A sample screen displaying this question is shown in Figure 4.2. Enter "1" to select specified lengths or "2" to select random lengths. If you entered "1" proceed to step 4.2A. If you selected random lengths, proceed to step 4.2B.

AGARIS, Advanced Gang Rip Simulator
Forestry Sciences Laboratory, Princeton WV

Create New System Options List

Cutting Length Options

Cutting Length Determination

1: Specified lengths
2: Random lengths

Enter selection for cutting length, 1 or 2: 1

Figure 4.2. Cutting-length type selection screen.

4.2A Defining Specified Lengths

You may use as many as 10 lengths. Figure 4.2A shows a session for which six specified lengths are used. Lengths must be entered in inches to the nearest 0.25 inch. If you enter a length that is not to the nearest 0.25 inch, AGARIS will round it to the nearest 0.25 inch. The order in which you enter the cutting lengths is not important. AGARIS automatically sorts the lengths in ascending order after you have entered all of them. When you have entered all of the specified lengths, proceed to step 4.3. You cannot leave this step until the number of length measurements entered is the same as the number of lengths specified.

```
AGARIS, Advanced Gang Rip Simulator
Forestry Sciences Laboratory, Princeton WV

Create New System Options List

Cutting Length Options

Cutting Length Determination

    1:  Specified lengths
    2:  Random lengths

Enter selection for cutting length, 1 or 2: 1

Number of part lengths to be used (10 max.): 6

    Enter part length  1 (inches): 12.75
    Enter part length  2 (inches): 18.00
    Enter part length  3 (inches): 27.50
    Enter part length  4 (inches): 32.00
    Enter part length  5 (inches): 38.25
    Enter part length  6 (inches): 46.50
```

Figure 4.2A. Specified cutting lengths screen.

4.2B Defining Random Lengths

When you select random lengths, you must specify minimum and maximum cutting lengths. These measurements must be entered in inches to the nearest 0.25 inch. In Figure 4.2B, the screen shows that the user has selected random lengths. Here the user has defined a minimum length of 12.00 inches and a maximum length of 60.00 inches. After you have specified minimum and maximum lengths, proceed to step 4.4.

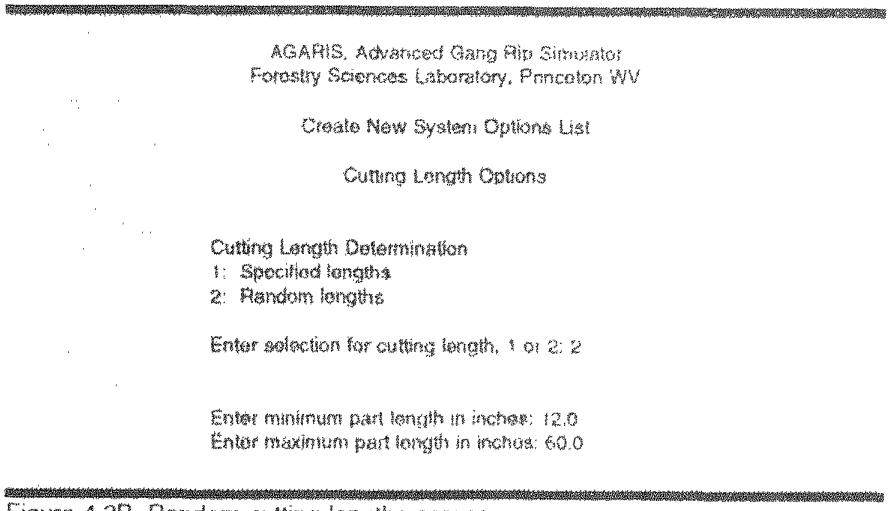

Figure 4.2B. Random cutting lengths screen

4.3 Primary Yield Maximization

Underlying all processing options is the optimization of yield based on the surface area of the primary cuttings. When three or more (maximum of 10) specified lengths are used, AGARIS allows three ways (see Figure 4.3) to maximize this surface area. Primary yield maximization refers to how the program fits the specified lengths in the space between two defects. For example, let the space between two defects be 84.00 inches and the specified cutting lengths be: 25.00, 29.00, 38.00, 45.00, and 72.00 inches. For simplicity, we will ignore kerf in this example. With the single longest length first option, the program will cut the 72.00-inch length and waste 12.00 inches. When the option for two longest lengths is chosen, AGARIS will cut a 45.00- and a 38.00-inch length for a total of 83.00 inches of yield and 1.00 inch of waste. The two length option first generates the single longest results and then examines the space between the defects to see if two lengths will give the same or greater yields. If so, the two lengths are used. Similarly, results of the three length option will be used if they are equal or greater than either the two or single length options. For the three length option, two 29.00-inch lengths and one 25.00-inch length are used because the total of 83.00 inches of primary cuttings is the same as the two length option.

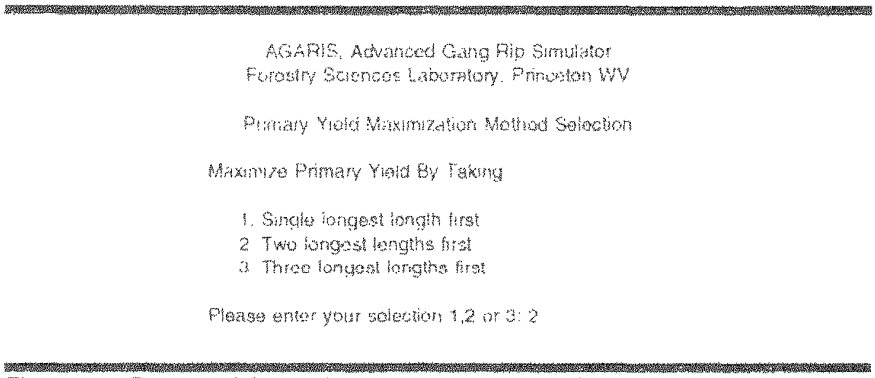

Figure 4.3. Primary yield maximization method selection screen.

Enter "1" if you want to take the single longest length first, "2" to take two longest lengths first, or "3" to take three longest lengths first. When you have entered your selection, proceed to step 4.4.

Step 4.4 Arbor Selection

There are three arbor types:

1. The variable arbor (choice 1) allows the specification of as many as three gang-ripped strip widths (in six saw spacings) for each board. They will be arranged by the computer in the sequence that gives the maximum yield of primary rough-dimension parts obtained by crosscutting the ripped strips to length. If the strip widths plus kerf do not equal the board width, an edging will be examined for salvage yield. The edging will have no effect on the saw spacing sequence. AGARIS allows the saw space sequencing to start at the left or right edge of the board.

2. The fixed arbor (choice 2) allows the specification of as many as three strip widths (in six saw spacings) in a specified sequence from one edge of the board. If the strip widths plus kerfs do not equal the board width, an edging will be generated that will be examined for salvage cuttings. While the yield will be optimized based on primary cuttings within strips, no variation in strip width sequencing, as with the variable arbor, is allowed.

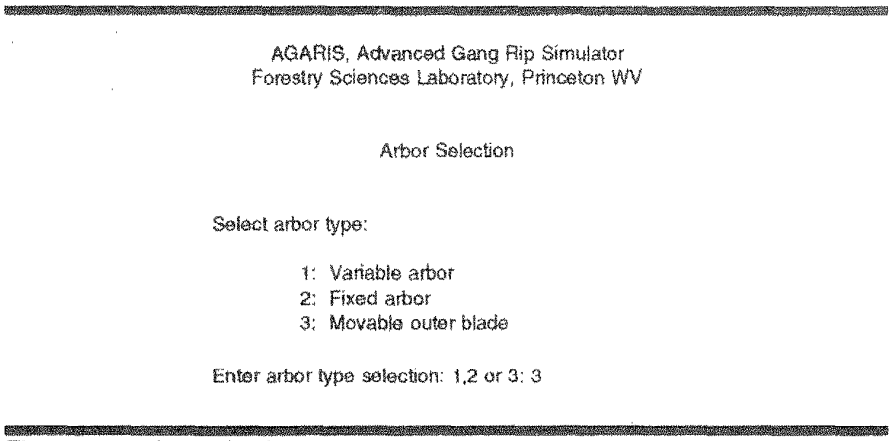

Figure 4.4. Arbor selection screen.

3. The movable outer blade arbor (choice 3) does not generate edgings and is useful when working on data files that contain random-width boards. A strip width that is to be repeated is specified. Another narrower strip width that is the narrowest allowable primary strip width also is specified. As the computer approaches the outer edge of the board and finds it cannot fit another preferred width, it examines the remainder. If the narrowest width or more remains, the program saws it. If less remains, the computer does not saw the last preferred width. Instead, it moves the blade out to the edge for a single, wider cutting. Yield will be optimized based on the primary cuttings within the strips.

The arbor selection screen is shown in Figure 4.4. If you are simulating the movable outer blade arbor, go to step 4.8. Otherwise, proceed to step 4.5.

4.5 Defining Primary Strip Widths

If you selected either a variable-sequence arbor or a fixed-sequence arbor, the screen shown in Figure 4.5 will appear. Here you define the strip widths. First, specify the number of widths desired. You can have as many as three different strip widths. Then, enter each width in inches to the nearest 0.25 inch. **Be sure to include a decimal point with each width.** The order in which you enter the widths is not important as AGARIS automatically will sort them in ascending order when you are finished.

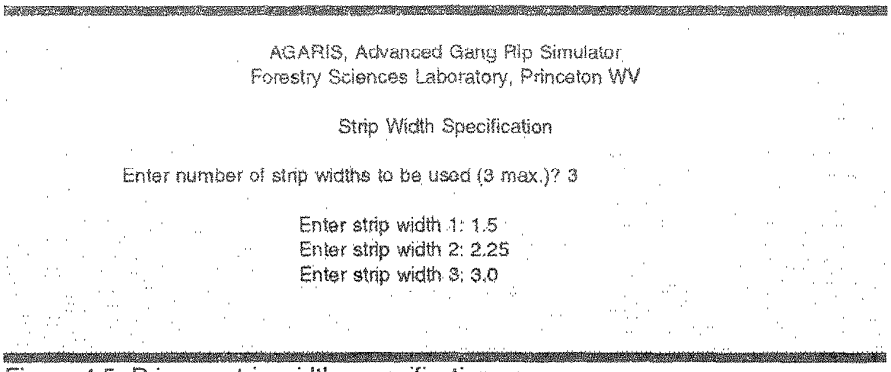

Figure 4.5. Primary strip widths specification screen.

If you are using a fixed arbor, proceed to step 4.6 to specify your width sequences. If you are using a variable arbor, proceed to step 4.7.

4.6 Fixed Arbor Width Sequencing

If you specified the use of a fixed-sequence arbor, you will see the fixed-arbor setup screen shown in Figure 4.6. This screen displays the primary part widths and reference numbers. There also is a six saw-space sequence that must be defined. Saw spacing 1 is the spacing next to the fence. Enter the reference number that identifies the strip width for this spacing. Figure 4.6 shows a sample session in which the user has entered a 3 for saw spacing 1. If you enter an invalid reference number, you will be prompted to reenter that spacing. You must specify six saw spacings even if one or more will not be used. This could occur when the boards in a data file are narrower than the sum of all the spacings and kerfs.

When you have completed this step, proceed to step 4.7.

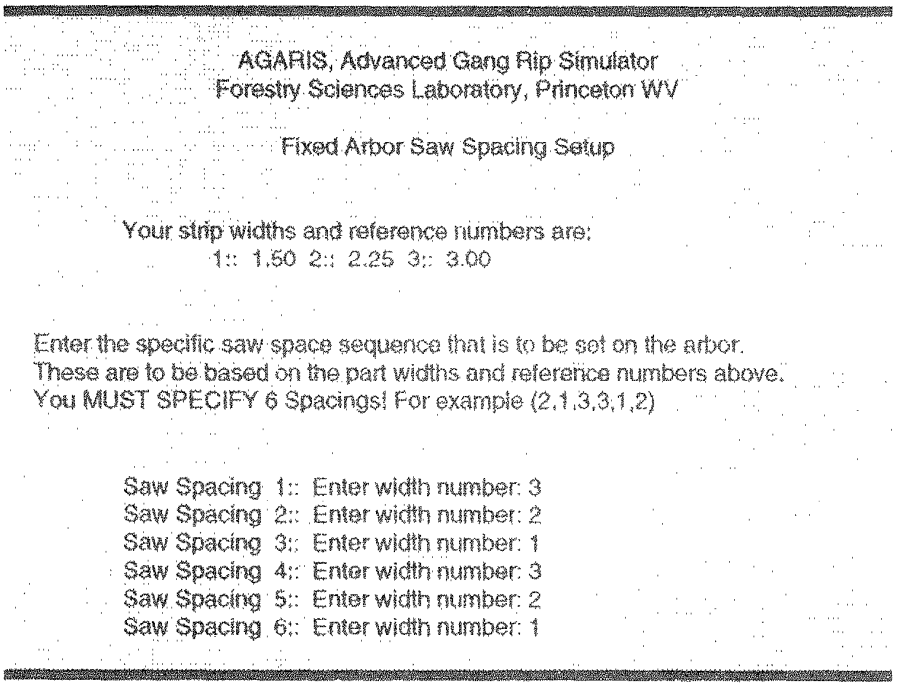

Figure 4.6. Fixed blade arbor setup screen.

4.7 Specifying Board Processing Direction

This step allows you to choose the direction in which to process boards. The standard way in which AGARIS processes boards is from the right edge to the left edge. The relationship between the board, saws, and fence with respect to the processing direction is shown in Figure 4.7A. To process boards in this manner, enter "1" at the prompt shown in Figure 4.7B. To process boards from the left edge to the right edge, enter "2". Processing boards from the left edge to the right is a nonstandard option. To prevent you from using this option unknowingly, you are asked if you really want this option when exiting the runtime options menu. This menu is shown in Figure 4.12. After you have selected a board processing direction, proceed to step 4.9.

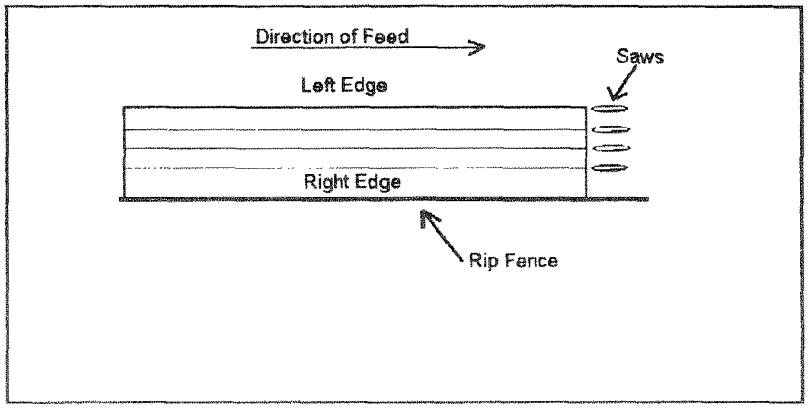

Figure 4.7A. Board, fence, and saw relationships.

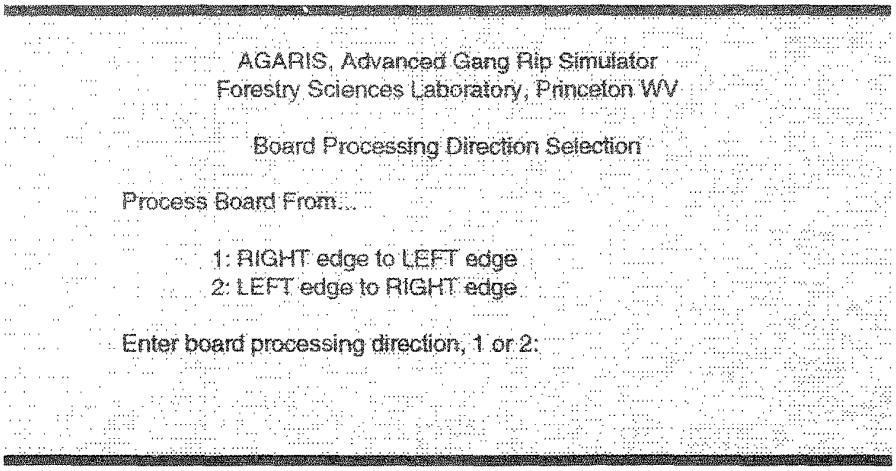

Figure 4.7B. Board processing direction selection screen.

4.8 Floating Outer Blade Arbor Setup

For the floating outer blade arbor, two widths must be entered. Both measurements are in inches to the nearest 0.25 inch. The first width is the preferred strip width which is repeated across the face of the board. The second measurement is the narrowest primary strip width that is acceptable. As the computer approaches the outer edge of the board and finds it cannot fit another preferred width, it examines the remainder. If the narrowest width or more remains, the program saws it. If less remains, the computer does not saw the last preferred width. Instead, it moves the blade out to the edge for a single, wider cutting.

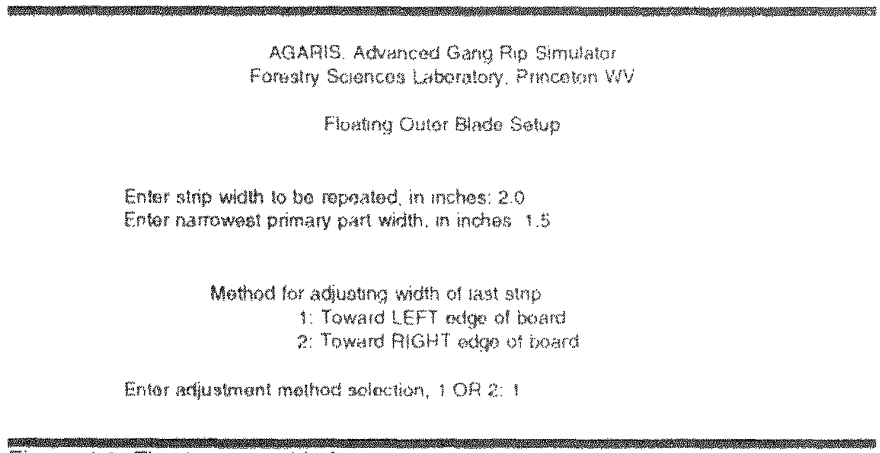

Figure 4.8. Floating outer blade setup screen.

Figure 4.8 shows the entry of 2.00-inch preferred and 1.50-inch narrowest strip widths. After the widths are entered, the computer prompts for the method of adjusting the width of the last strip. Enter "1" to adjust the width of the last strip toward the left fence, or "2" to adjust toward the right fence. In Figure 4.8 we have opted to adjust the width of the last strip toward the left fence.

Proceed to step 4.9.

4.9 Salvage and Edging Specification

The first item you are asked for is the minimum width for salvage. This measurement must be entered in inches to the nearest 0.25 inch. **Note that the smallest allowable measurement for salvage is 0.75 inch.** If a smaller width is entered, it will be displayed in asterisks on the run time options screen (Figure 4.12). Figure 4.9 shows an example where the user has entered 1.0 inch for the minimum salvage width.

Next, specify whether or not you want the boards edged on both edges. If you enter "Y", the boards will be edged. Otherwise, edging will not take place. If you select edging, you will be asked for the amount of the edging in 1/4-inch increments, e.g., 1 for 1/4 inch, 2 for 2/4 inch, and so on. **Do not enter a decimal point for this measurement.** In this example we have specified that the boards are to be edged 0.25 inch on both sides.

If you specified that you wanted summary tables at the initial options screen, proceed to step 4.10. Otherwise, go to step 4.12.

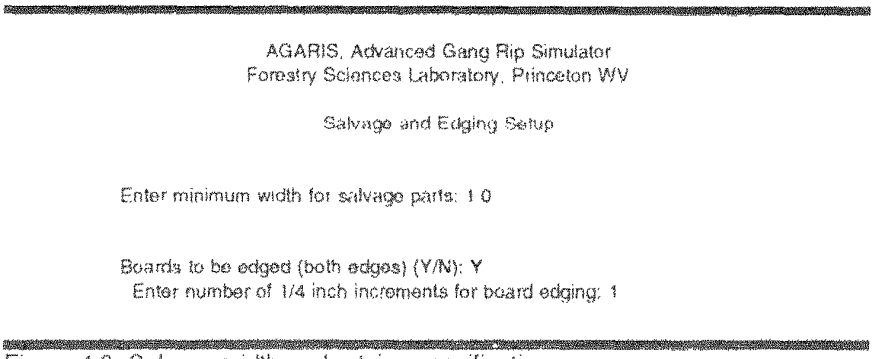

Figure 4.9. Salvage width and edging specification screen.

4.10 Specifying Width Ranges

If you specified that you wanted summary tables at the startup screen, you must define a set of width ranges. Width ranges allow yield information to be grouped into 1 to 15 different subtotals depending on the user's interest. We caution against using the specified widths to begin or end a width range. This will avoid potential rounding problems on some computers. For example, to specify a range that contains the widths 1.5 and 1.75, an A value of 1.4 and a B value of 1.8 could be used for the range. The exact values are not important. However, the **values must bracket the included widths** and the **bracket values must not overlap other ranges.** A further restriction is that **there can be no gap in the ranges that can allow a width to be excluded.** For example, the ranges .90 to 2.10 and 2.6 to 3.4 would skip the widths 2.25, and 2.50. AGARIS will check to see that there is no overlapping or gaps in the specified ranges. If problems are found, they are reported when you exit to the runtime options screen (Fig. 4.12). Appendix II is a complete list of errors reported by AGARIS and possible actions to correct them.

```
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              Forestry Sciences Laboratory, Princeton WV

                          Width Range Setup

Enter number of width ranges to use, (max 15): 3

   Enter all range values in inches, to nearest 0.25 inch.
   The A value for range  1 must be less than 1.00.

         Range  1:  A<=X<=B, Enter A: .90
                                      B: 1.8

         Range  2:  A<=X<=B, Enter A: 1.9
                                      B: 2.8

   The B value for range 3 must be greater than 3.50.

         Range  3:  A<=X<=B, Enter A: 2.9
                                      B: 3.6
```

Figure 4.10. Width range definition screen.

The screen shown in Figure 4.10 shows an example where the user has specified three width ranges. The first prompt asks how many width ranges are needed. You may specify any number from 1 to 15. The computer will then prompt you for each of the two values in each range. The A value of the first range must be less than the smallest width specified. The smallest width possible is the minimum salvage width. In addition, the B value of the last range must be greater than the widest width possible. Both of these messages and widths are displayed on the screen for the appropriate range (Fig. 4.10).

If you are using random lengths, proceed to step 4.11. Otherwise, go to step 4.12.

4.11 Specifying Length Ranges for Random Lengths

When studying random lengths, it is useful to group the results into length ranges. Otherwise, the summary tables will contain statistics on each random length obtained in the AGARIS run. If you are using random lengths and specified that you wanted summary tables, you have the option of defining length ranges for the summaries. If you want length ranges, answer "Y" to the prompt displayed at the top of the screen shown in Figure 4.11. Then enter the number of length ranges that you want. Any integer number 1 through 10 is acceptable. If you do not want length range information in the summary tables, enter "N" and proceed to step 4.12.

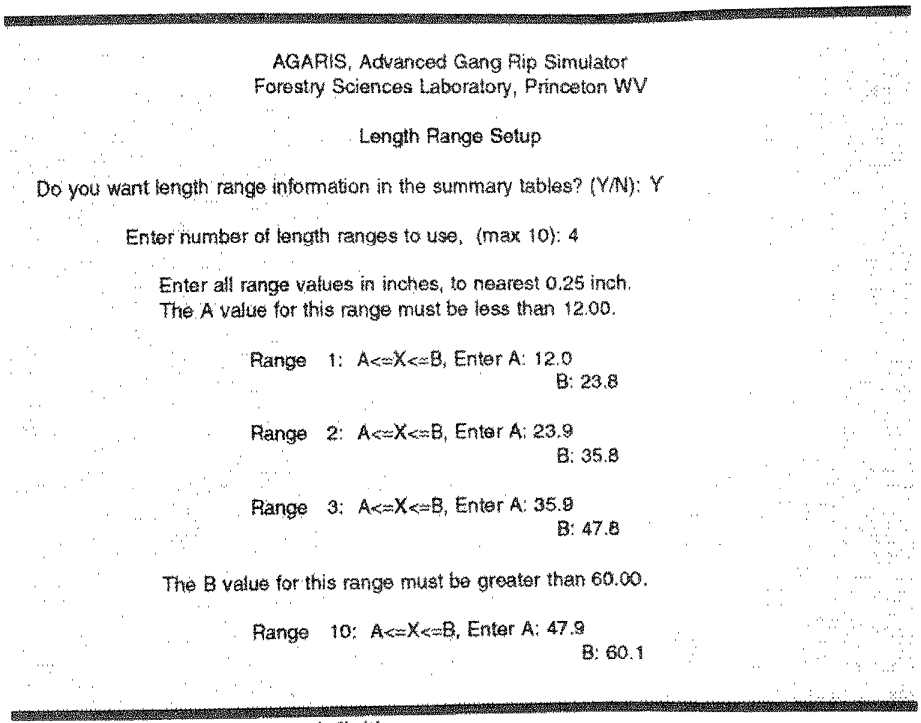

Figure 4.11. Length range definition screen.

As with width ranges, the A value of the first range must be less than the smallest length possible. Similarly, the B value of the last range must be greater than the longest length possible. Both of these messages and lengths are displayed on the screen for the appropriate range (Fig. 4.11). When specifying a range it is best if you bracket the lengths by a lesser and a greater length. For example, to specify a range that contains the lengths 12.0, 16.0, and 24.0 inches, you can enter an A value of 11.9 and a B value of 24.1 for the range. As with width ranges, **the exact values are not important so long as the values bracket the range of lengths and the range values are not repeated.** A further restriction is that **there can be no gap in the ranges that can allow a cutting length to be excluded.** For example, the ranges 10.00 to 20.00 and 21.00 to 29.00 would skip the lengths 20.25, 20.50 and 20.75. AGARIS will report any errors in the length ranges and ask you to correct them. You are notified of any errors when you attempt to exit the runtime options screen, shown (Fig. 4.12).

4.12 The Options Summary Screen

After you have answered all of the questions needed to create a new options list, AGARIS will display the options summary screen (Fig. 4.12).

```
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                  Forestry Sciences Laboratory, Princeton WV

Part lengths are SPECIFIED
Part lengths (MAX 10) (inches):  12.75  18.00  27.50  32.00  38.25  46.50
Primary yield maximization method: TWO LONGEST LENGTHS FIRST
Arbor type is MOVABLE OUTER BLADE
Strip width to be repeated (inches) ..... 2.00
Narrowest primary width (inches) ..... 1.50
Width of last strip adjusted toward LEFT edge of board
Width ranges:
                    .90     1.90     2.90
                   1.80     2.80     3.80
Boards will be edged 1/4 inch on both sides
Minimum width for salvage parts (inches) ... ..... 1.00

1: Use current settings, 2: Modify settings, 3: Recreate settings:
```

Figure 4.12. Runtime options display screen

This screen is a summary of all of the settings that were specified during the creation process. If you have run AGARIS before, you will see this screen immediately after answering the two questions on the startup screen (Fig. 3). If you decide that the options displayed are the ones that you want, enter "1". AGARIS will check for problems in the options list. If you have specified an invalid width or length range, you will be notified of the problem. After you have read the error report, press the return key and you will automatically be ready to make the necessary changes to the options list. Refer to Section 5 for assistance in modifying the options list. If you specified that the boards are to be processed from left to right, you will be notified that you are using a nonstandard option. If this option is desired enter "Y"; if not, enter "N". If you enter "N", the boards will be processed from right to left. If there are no errors or warnings, you will be asked to select a data file. Refer to Section 6 for information on data file selection. Appendix II explains all errors that are reported by the AGARIS programs.

If you see a problem with the settings or an option you do not like, enter "2". This will allow you to correct your setup options. See Section 5 for an explanation of this operation. If you decide that all of the options are no longer wanted, you can recreate them by selecting "3". To help guide you through the choices, turn to the beginning of this section.

5. Modifying Existing Options List

To modify an existing options list, simply enter the number of the item you wish to change from the modify menu. Then make the desired changes. The main modification menu for the setup options is shown in Figure 5. The options shown are those from Figure 4.12. Notice that the modification menu shows only those options that are currently specified. As changes are made in the options list, the contents of the screen will change to reflect those changes. The remainder of Section 5 will lead you through a series of modifications that will end with a fixed arbor and random-part lengths. These (and other) changes are reflected in the option list displayed in Figure 5.10B. Although the following examples are shown in sequence, you can modify any item whenever you wish.

```
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Option List Modification

1: Cutting lengths are SPECIFIED
   1A: View or change specified lengths
2: Primary yield maximization method: TWO LONGEST LENGTHS FIRST

Arbor Settings:
3: Arbor type is  MOVABLE OUTER BLADE
4C: Strip width to be repeated:  2.00
5: Minimum primary strip width:  1.50
6: Width of last strip adjusted toward LEFT edge of board
7: Minimum width for salvage:  1.00
8A: Boards will be edged
   8B: Amount of edging in qtr. inches: 1
9: View or Change width ranges

Enter number of item to change or 0 to EXIT modification menu:
```

Figure 5. Setup options main modification screen.

CAUTION: AGARIS allows entering lengths and widths in any order. These values are then sorted in ascending order. When a fixed arbor is used, the addition of or change to a strip width that is narrower than the largest previously specified will automatically cause a change in the saw-spacing sequence. See 5.3 and 5.4 for further details.

5.1 Changing From Specified to Random Cutting Lengths

This example shows how to change cutting lengths from specified to random or from random to specified. To change the cutting-length type select item "1" from the main modification screen (Fig. 5). The computer will display the screen shown in Figure 5.1A.

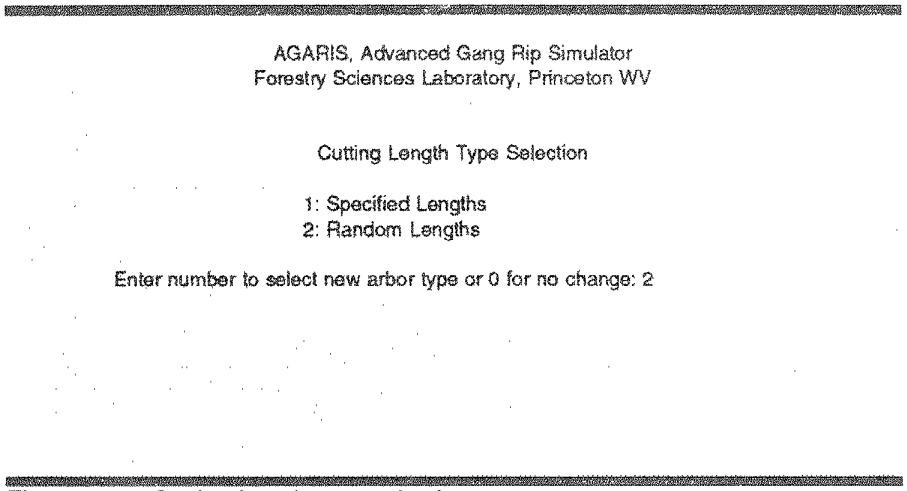

Figure 5.1A. Cutting-length type selection screen.

Enter "0" or press return if you decide not to change the current setting. Otherwise, enter "2" to select random cutting lengths. You will then be asked to specify the minimum and maximum part lengths, items "1B" and "1C" on the modification menu (Fig. 5.1B). If you do not want each random length listed in the summary table, choose "1D" to activate the length range summary option. Modifying the minimum and maximum part lengths is covered in 5.2. Figure 5.1B shows the main modification menu after the cutting length type has been modified. Notice that the options regarding the cutting lengths have changed considerably.

If you later decide that you want specified lengths, select "1" from the main modification menu and "1" from the cutting length type modification menu. The computer will then tell you to also modify item "1A", the specified part lengths.

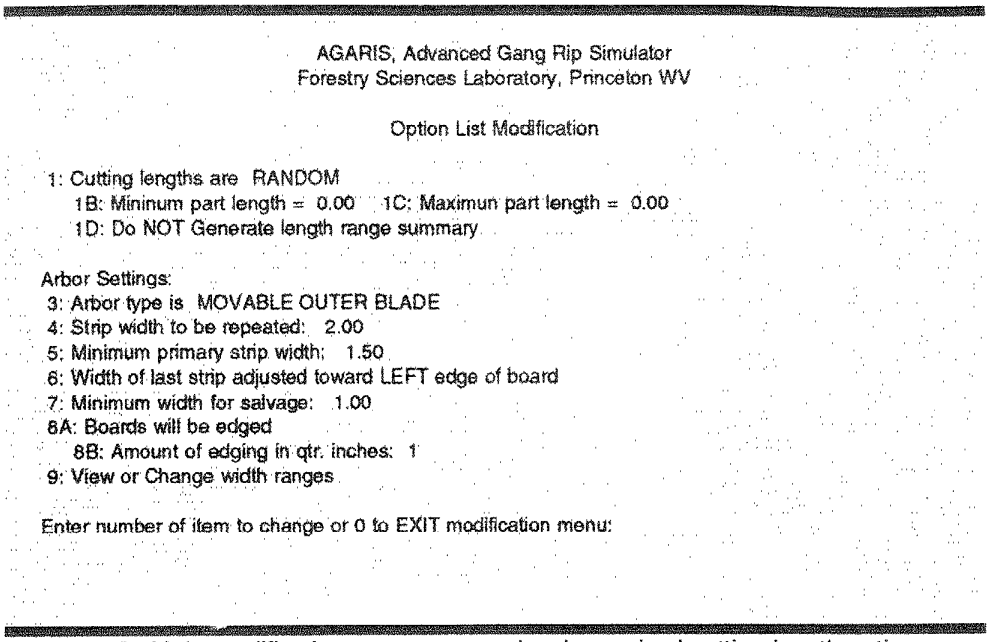

Figure 5.1B. Main modification menu screen showing revised cutting-length options.

5.2 Specifying Minimum and Maximum Part Lengths

This example shows how to specify minimum and maximum part lengths when using random part lengths. To specify a new minimum part length select item "1B" from the main modification screen (Fig. 5.1B). The computer will display the old minimum part length and prompt for a new one. Since we have just switched from specified lengths, the previous value is 0.00. Figure 5.2A shows the minimum part length modification screen. Here we are entering a new minimum part length of 15.00 inches.

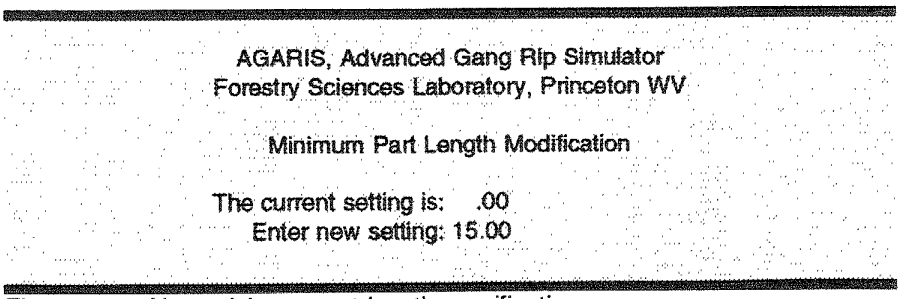

Figure 5.2A. New minimum part length specification screen.

The second part of this example shows how to modify the maximum part length. First select item "1C" from the main modification menu (Fig. 5.1B). The computer then prompts for the new value. For the maximum part length we will enter a value of 60.00 inches (Fig. 5.2B). **Again, be sure this amount includes a decimal point.**

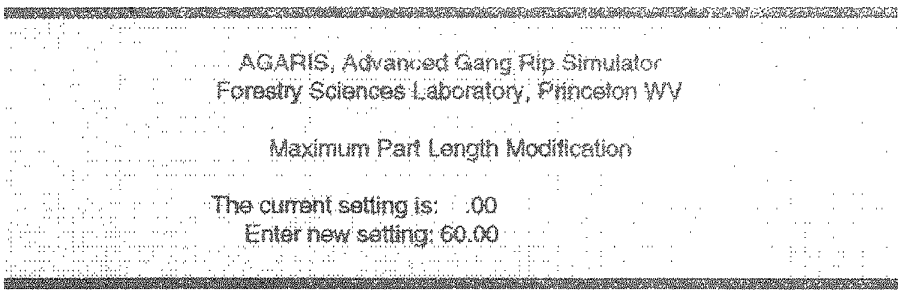

Figure 5.2B. New maximum part length specification screen.

5.3 Modifying Arbor Type

To change the arbor type, select item 3 from the main modification menu (Fig. 5.1B). The arbor modification screen is shown in Figure 5.3A.

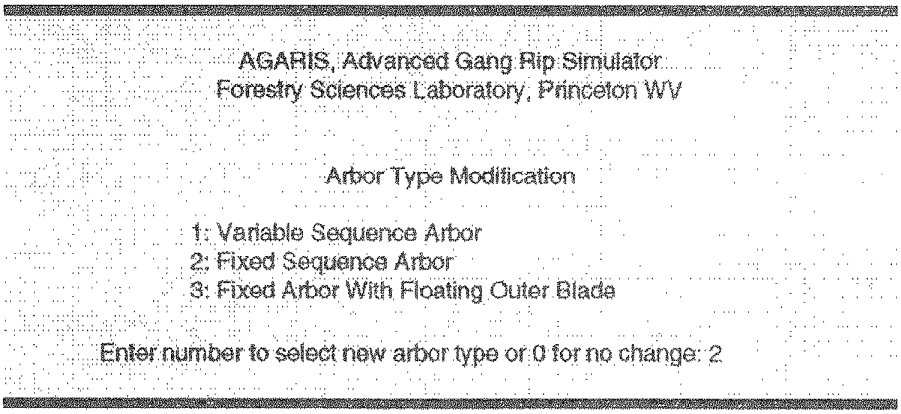

Figure 5.3A. Arbor selection screen.

If you do not want to change the current arbor type, enter "0" or press return. If you want to use the variable arbor, enter "1". The variable arbor automatically picks the optimum rip sequence for each board. To select a fixed-blade arbor, enter "2". You will be told to modify items "4A" (primary strip widths) and "4B" (fixed arbor saw spacings). These modifications are made in 5.4 and 5.5. In this example, we will select "2", the fixed- sequence arbor. Figure 5.3B shows the main modification menu after the arbor type has been modified.

If you select item "3", fixed arbor with a floating outer blade, you will have to modify items: "4C" (repeated strip width) and "5" (minimum primary width). Although no example shows the modification of items "4C" and "5", doing so is similar to modifying the minimum salvage width shown in 5.6.

```
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                              System Options Modification

 1: Cutting lengths are RANDOM
    1B: Minimum part length = 15.00    1C: Maximum part length = 60.00
    1D: Do NOT Generate length range summary

Arbor Settings:
 3: Arbor type is  FIXED
 4A: Strip widths (Max of 3):  2.00
    4B: View or change strip sequence:
    4D: Processing from RIGHT edge of board
 7: Minimum width for salvage:   1.00
 8A: Boards will be edged
    8B: Amount of edging in qtr. inches:  1
 9: View or Change width ranges

Enter number of item to change or 0 to EXIT modification menu:
```

Figure 5.3B. Main modification screen showing revised arbor type modifications.

5.4 Modifying Primary Part Widths

To modify or view the strip widths, select item "4A" from the main modification menu (Figure 5.3B). You will then see a listing of all the primary part widths (Fig. 5.4A).

```
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                              Strip Width Modification


                          1   2.00
                          2    .00
                          3    .00

                    Enter number of element to change or 0 to EXIT: 3
```

Figure 5.4A. Primary strip-width modification screen.

To modify or add a strip width enter the number of the desired width. You will then see the screen in Figure 5.4B.

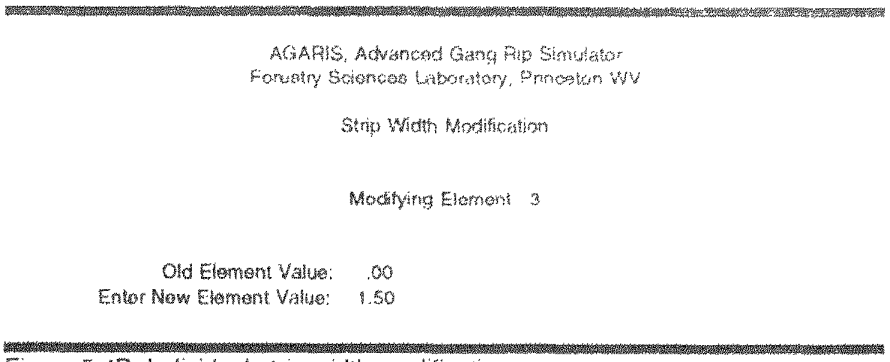

Figure 5.4B. Individual strip-width modification screen.

This screen shows the number (3) of the width being modified and the old width value (.00) and prompts you for a new width (1.50). Once you select a width number, you must enter a new value for the part width. The widths must be entered in inches, to the nearest 0.25 inch. If you enter a 0 width or press return, the old width will be replaced by 0. To remove a width, select it and enter 0. The modified widths do not have to be in any particular order, nor do you have to modify them in any particular order. In this example, width #3 is replaced with a 1.50-inch width. In addition, we will replace width #2 with a 2.25-inch width and width #1 with a 3.00-inch width.

When you exit from part width modification, two things will happen: 1) Any 0 value widths are moved to the end of the width list; 2) The remaining widths are sorted in ascending order. The order of the strip widths after modification will be: 1.50, 2.25, and 3.00 inches. **If you are using a fixed blade arbor and the order of the part widths change, the order of the fixed arbor sequence also will change.** It is a good idea to check the fixed arbor saw sequence whenever you modify primary strip widths. See 5.5 to modify the fixed-arbor saw sequence

5.5 Modifying Fixed Arbor Strip Sequences

To modify fixed arbor strip sequences, select item "4B" from the modification menu. You will then see a list of the strip widths and how they are sequenced on the arbor. As we are changing from the floating outer blade arbor, all sequence widths are the repeated strip width. Figure 5.5 shows that we have defined three strip widths, 1.50, 2.25, and 3.00 inches. There are six saw spacings that must be identified as using one of the three defined strip widths. For Figure 5.5, the strip width index numbers were entered in the following sequence: 1,1,3,2,3,1. What is illustrated is the decision to change the fourth saw spacing to yield a 1.50-inch strip rather than a 2.25-inch strip. This is accomplished by assigning strip width 1 to saw spacing 4. If you select a spacing, you also must select a replacement width. After you specify the replacement width, the screen is redrawn to show the new spacing on the arbor. To exit spacing order modification, enter a "0" at the prompt for the spacing number.

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Modify Specified Order Saw Spacing

This routine allows you to change the order of the 6 strip widths on the arbor.

You have 3 strip widths to pick from 1: 1.50 2: 2.25 3: 3.00

1 :: 1.50
2 :: 1.50
3 :: 3.00
4 :: 2.25
5 :: 3.00
6 :: 1.50

Enter number of spacing to change or 0 to EXIT: 4

Enter index number of replacement width for spacing 4: 1

Figure 5.5 Fixed arbor strip sequence modification screen.

5.6 Modifying Minimum Salvage Width

Selecting item 7 from the main modification menu (Fig. 5.3B) will allow you to modify the minimum salvage width. The computer will display the screen shown in Figure 5.6. This screen shows you the old minimum salvage width and prompts you to enter a new one. The new width must be entered in inches to the nearest 0.25 inch. The minimum acceptable salvage width is 0.75 inch. If you enter a smaller width, the salvage width field will be covered with asterisks at the main modification screen.

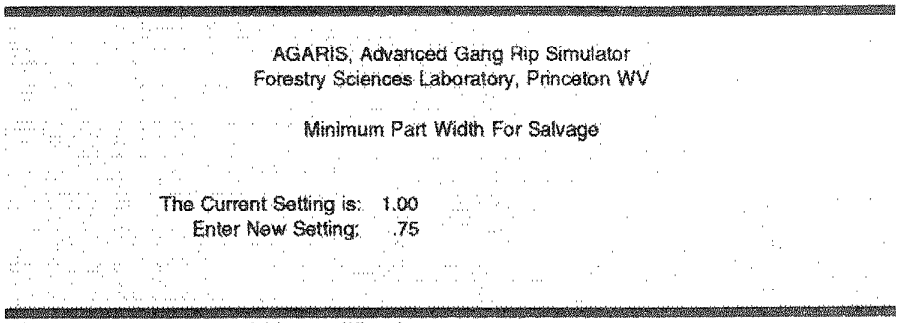

Figure 5.6. Salvage width modification screen.

5.7 Modifying the Edging Amount

This example shows how to activate and deactivate edging, as well as how to specify a new edging amount. To activate or deactivate edging, select item "8A" from the modification menu (Fig. 5.3B). The computer responds by displaying the screen shown in Figure 5.7A. Enter "1" to deactivate edging or "2" to activate edging. If you decide to keep the current edging status, enter "0" or press return. For this example, "2" is entered.

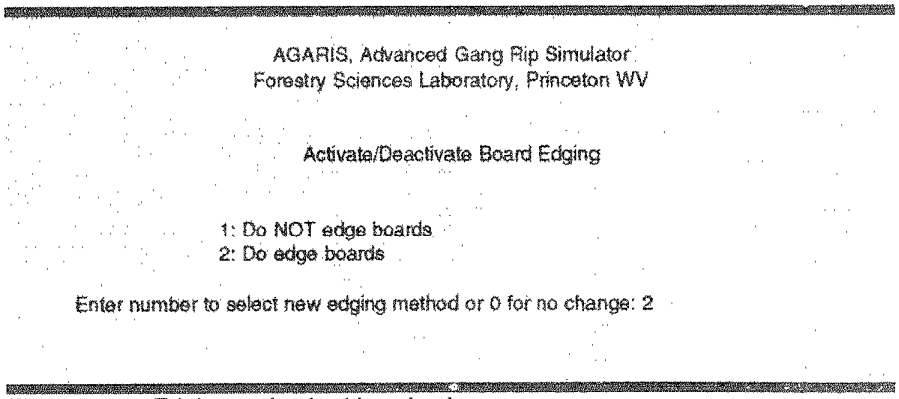

Figure 5.7A. Edging activation/deactivation screen.

After you activate edging, you must specify an edging amount. To do this, select item "8B" from the modification menu. This will bring up the screen shown in Figure 5.7B. This screen displays the current edging amount in quarter-inch increments, e.g., 1 = 1/4-inch and 2 = 2/4-inches. At the prompt, enter the new edging amount in quarter-inch increments. **Do not enter a decimal point with this number.** For this example we specify 2/4 inches of edging from each edge.

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Edging Amount In Quarter Inch Increments

The Current Setting is: 1

Figure 5.7B. Edging size modification screen.

5.8 Modifying Width Ranges

In this example you are shown how to modify width ranges. The steps covered here can be applied to modifying length ranges when conducting random length runs. To modify width ranges, select item "9" from the modification menu (Fig. 5.3B). You will then see the screen in Figure 5.8A. The minimum and maximum range values are shown at the top of the screen. The lower value of the smallest range must be less than the minimum value shown. Similarly, the upper value of the largest range must be greater than the maximum value shown.

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Range of Widths Modification

Maximum of 15 Ranges

The lower value of the first range must be less than .75
The upper value of the last range must be greater than 3.00

1	.90	1.80
2	1.90	2.80
3	2.90	3.60
4	.00	.00
5	.00	.00
6	.00	.00
7	.00	.00
8	.00	.00
9	.00	.00
10	.00	.00
11	.00	.00
12	.00	.00
13	.00	.00
14	.00	.00
15	.00	.00

Figure 5.8A. Main width range display/modification screen.

To modify a specific range, enter the range number. Figure 5.8B shows the screen used to modify individual ranges. Once you select a range you must enter a new lower and upper value for the range. In this example we are modifying the first range, specifying .70 and 1.80 as the lower and upper bounds. To erase a range, enter a 0 for both the upper and lower range values. If you need to make a range between existing ranges, modify any range with has 0 values. The computer will place the range correctly later.

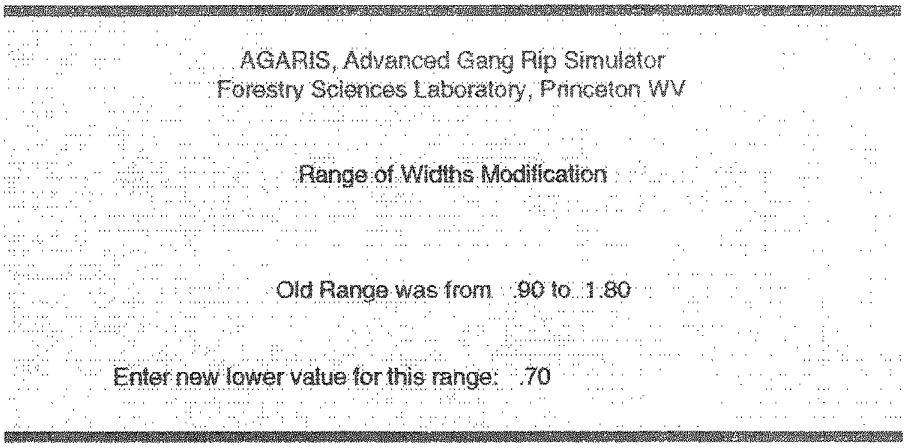

Figure 5.8B. Range element modification screen.

Your ranges will be sorted and placed in the correct order when you exit range modification. The program also checks your ranges for three possible problems: 1) Is the smallest value of the first range less than the minimum width? 2) Is the largest value of the last range greater than the maximum width? 3) Are there gaps in the ranges that could allow a width to be missed? These same checks are performed when you exit the main modification menu.

5.9 Enabling and Modifying Length Ranges for Random Lengths

When studying random lengths, it is useful to group the results into length ranges. Otherwise, the summary tables will contain statistics on each random length obtained in the AGARIS run.
To activate length ranges, select item "1D" from the main modification menu (Fig. 5.3B). This will bring up the length range activation menu (Fig. 5.9A).

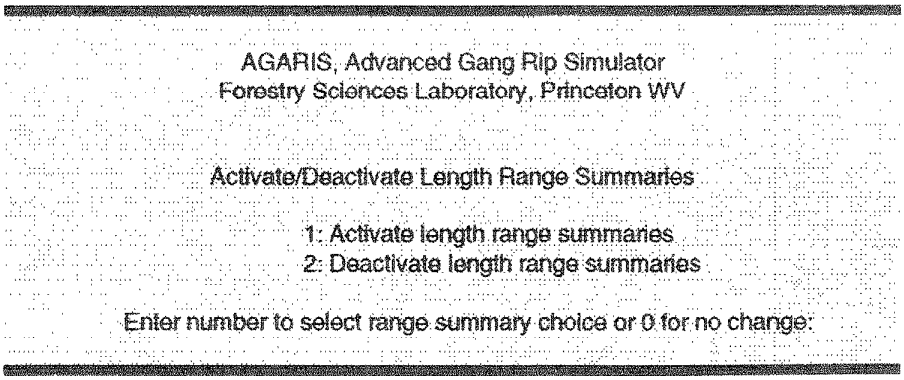

Figure 5.9A. Length range summary activation/deactivation menu.

Enter "1" to activate length range summaries. AGARIS will then notify you that the length ranges (item "1E" in Figure 5.10A) should now be checked. To view or modify the length ranges, select item "1E" from the main modification menu (Fig. 5.10A). The computer will then display the length range modification screen (Fig. 5.9B). The minimum and maximum length range values are shown at the top of the screen. The lower value of the smallest range must be less than the minimum value shown. Similarly, the upper value of the largest range must be greater than the maximum value shown. All of the defined length ranges are shown in the center of the screen.

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Range of Lengths Modification
Maximum of 10 ranges

The lower value of the first range must be less than 15.00
The upper value of the last range must be greater than 60.00

1	.00	.00
2	.00	.00
3	.00	.00
4	.00	.00
5	.00	.00
6	.00	.00
7	.00	.00
8	.00	.00
9	.00	.00
10	.00	.00

Enter number of range to change or X to EXIT:

Figure 5.9B. Main length range display/modification screen.

To modify a length range, enter the number of the range you wish to modify. We will begin by modifying the first range. After selecting a range, the computer will display the range modification screen (Fig. 5.9C). This screen shows the old values (all zeroes) for the range and prompts for new

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Range of Lengths Modification

Old range was from .00 to .00

Enter new lower value for this range: 14.9
Enter new upper value for this range: 23.8

Figure 5.9C. Length range element modification screen.

upper and lower values to be entered. **Be sure to enter the range values in inches with a decimal point.** In Figure 5.9C we have specified a lower value of 14.9 and an upper value of 23.8 for the first range. After the value for the upper range is entered, the main length range display/modification screen (Fig. 5.9A) is shown with the updated range values. Although not specifically shown in an example, we also will define the following ranges:

	Lower value	Upper value
2:	23.90	35.80
3:	35.90	47.80
4:	47.90	60.10

These ranges are to be entered in exactly the same manner as the first range. Once you are satisfied with the current length ranges, enter 0 to return to the main modification menu (Fig. 5.10). When you exit length range modification, your ranges will be checked for errors. If any errors are found, you will be notified of the error and asked to correct it.

5.10 The Modified Options List

Figure 5.10A shows the completed options list after all modifications have been performed. Enter "0" to exit from the modification menu. You will then be returned to the options display screen (Fig. 5.10B). If you are satisfied with the options list shown at the options summary screen, select "1" to begin the AGARIS analysis phase.

```
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Part lengths are RANDOM
Minimum part length:  15.00                 Maximum part length:  60.00
Length ranges:
                14.90    23.90    35.90    47.90
                23.80    35.80    47.80    60.10
Widths for primary parts (max. 3) (inches) ..... 1.50  2.25  3.00
Primary yield maximization method:  SINGLE LONGEST LENGTH FIRST
Arbor type is FIXED BLADE
     Order of saw spacing from RIGHT EDGE ..... 1  1  3  1  3  1
Width ranges:
                .70      1.90     2.90
                1.80     2.80     3.60
Boards will be edged 2/4 inch on both sides
Minimum width for salvage parts (inches) ..... .75

1: Use current settings, 2: Modify Settings, 3: Recreate Settings:
```

Figure 5.10B. Options display screen showing revised options list.

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Part lengths are RANDOM
Minimum part length: 15.00 Maximum part length: 60.00
Length ranges:

14.90	23.90	35.90	47.90
23.80	35.80	47.80	60.10

Widths for primary parts (max. 3) (inches) 1.50 2.25 3.00
Primary yield maximization method: SINGLE LONGEST LENGTH FIRST
Arbor type is FIXED BLADE
Order of saw spacing from RIGHT EDGE 1 1 3 1 3 1
Width ranges:

.70	1.90	2.90
1.80	2.80	3.60

Boards will be edged 2/4 inch on both sides
Minimum width for salvage parts (inches) ..... .75

1: Use current settings, 2: Modify Settings, 3: Recreate Settings:

Figure 5.10B. Options display screen showing revised options list.

6. Selecting a Data File

Immediately after you have decided to use the current settings, AGARIS will ask you to select a data file. A sample screen showing the files available from the distribution diskette is shown in Figure 6.

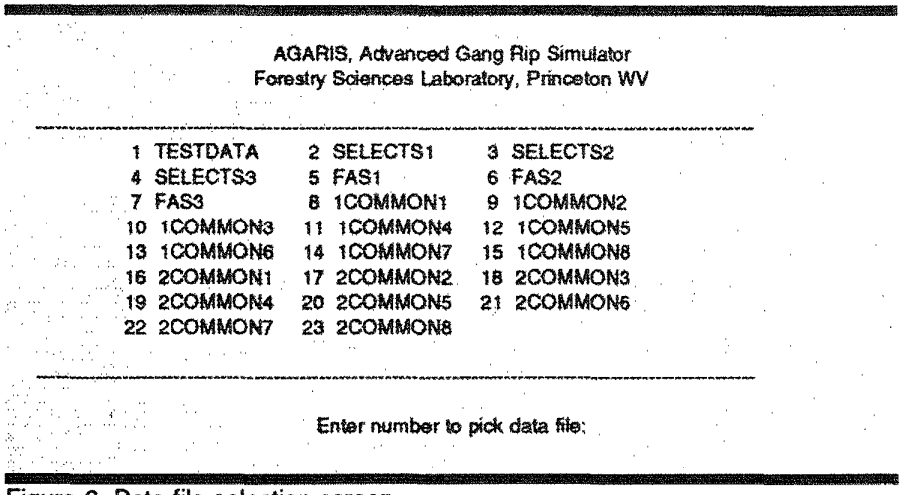


Figure 6. Data file selection screen.

This screen can display as many as 45 data files. If there are more than 45 data files, press return and you will be shown the next screen. To select a data file, enter the file reference number. Once you select a data file, AGARIS will immediately begin analyzing the chosen data file with respect to the setup options you defined. AGARIS displays the following message when analysis of the data file is complete.

******* LAST BOARD PROCESSED *******

7. The AGARIS Results

This section shows you how to use the summary and board plotting program and read the parts and summary tables. A report generation program that creates the summary tables is run automatically after the analysis phase is complete. When the report generator is finished (a few seconds), the summary program is run automatically. The main menu for the summary program is displayed in Figure 7.

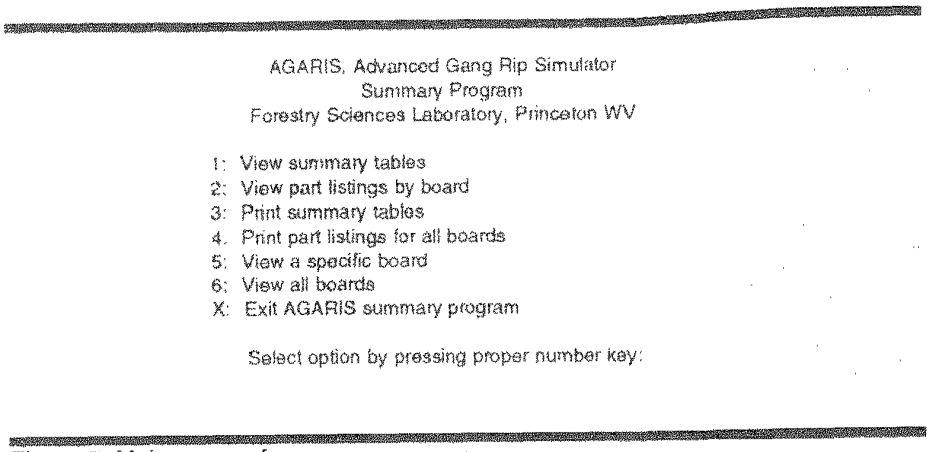


Figure 7. Main menu of summary program.

The main menu allows the user to easily view or print the summary tables and parts listings. The user can also obtain a plot of selected boards or of all the boards in the processed datafile. To exit from the summary program, press "0" at the main menu

Note: All of the examples shown in this section were generated using the TESTDATA data file along with the option list shown in Figure 3.3.

7.1 Viewing and Printing Summary Tables and Parts Listings

The summary tables provide detailed information on parts and yield for an AGARIS run, listing the number of parts generated, area, and percentage of parts by user-defined width and length ranges. The summary tables will be generated only if specified at the startup options screen (Fig. 3.2). To view the summary tables, select "1" from the main menu. The computer will display the summary table display screen. Figure 7.1A shows a sample summary screen where we have paged down through the tables to the Surface Area Yield Table. If you need help in moving around in the summary tables or parts listings, press "H". This will bring up the help window describing all available view options. Pressing any other key while viewing help will hide the help window.

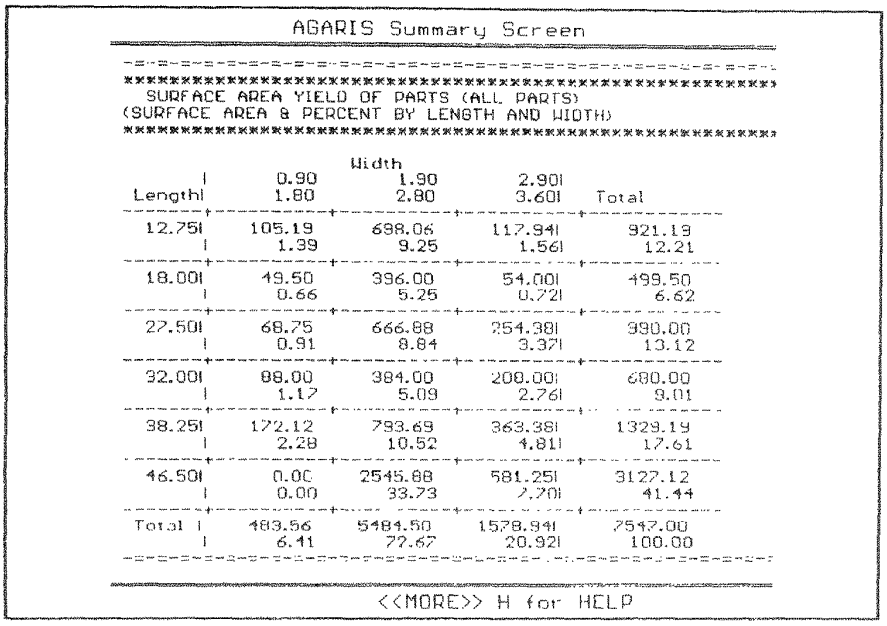


Figure 7.1A. Viewing a sample summary table.

AGARIS provides data in summary tables and board by board parts listings as follows:

Summary tables:

There are six summary tables that describe the distributions of the yields. The first three tables give the yield distributions based upon surface area (Fig. 7.1A). In each length-width cell, the upper number is the square inches of surface area and the lower number is the yield percentage in that length-width cell. The percentages in each table add to 100. The first table is the distribution of the total yield. The second and third tables contain the surface-area distributions for the primary and salvage cuttings. The last three tables are a repeat of the first three except that they are based on the number of parts.

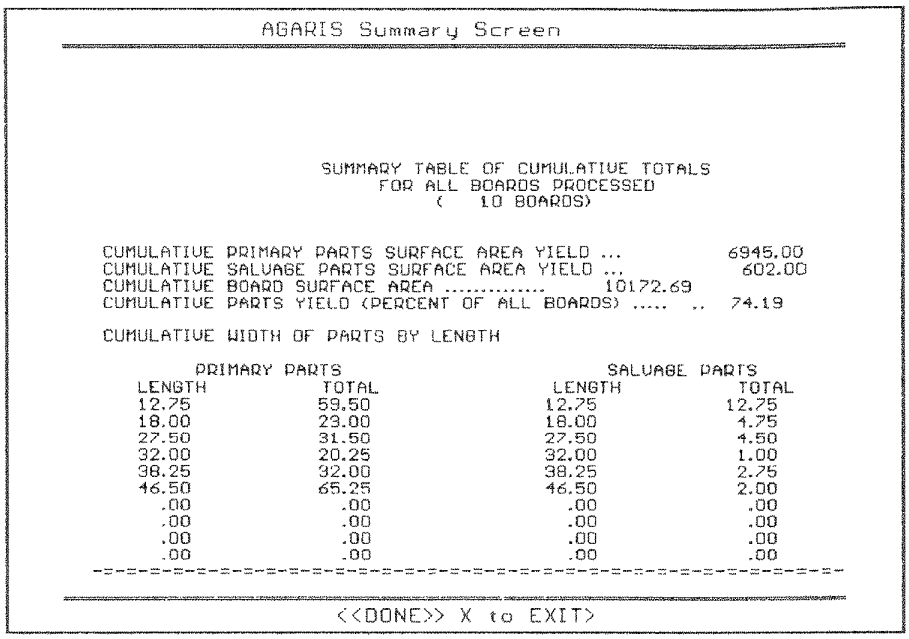


Figure 7.1B. Sample summary table showing summary listing.

At the end of the tables is a summary listing of the total square inches of board input and primary and salvage yield (Fig. 7.1B). For convenience, the total yield based on surface area is given. These values can be used to convert the yield distributions to another basis. For example, multiplying the total yield percentage by the percentage values given in the first table will, with the proper placement of the decimal point, give the total yield per thousand board feet.

Parts listings:

AGARIS provides a board-by-board listing of all boards in a given file. In Figures 7.1C and 7.1D, the parts for board 119 in file TESTDATA.DAT and the accumulated totals to that point are shown. For each board, the specific sizes and yield percentages of primary and salvage parts are given. A running total of surface areas and yields follows. The parts listings conclude with the accumulated width of each length in the runtime options (Fig. 7.1D).

If you want parts listings for only a few boards in a file and do not want to edit the larger file to create a smaller one, plot the desired boards (see 7.2) and accumulate the parts by hand.

Parts listings will be available if you specified their generation at the startup options screen (Fig. 3.2). To view the parts listings, select "2" from the main menu. A sample parts listing view screen is shown in Figure 7.1C.

There may be too many parts to be shown on one screen. The excluded portion can be seen by pressing the right arrow key to pan the screen to the right. Similarly, the left arrow key pans the screen to the left. To go to the first and last columns of the report, press the HOME and END keys. The up and down arrow keys move the table being displayed back and ahead one line at a time, respectively.

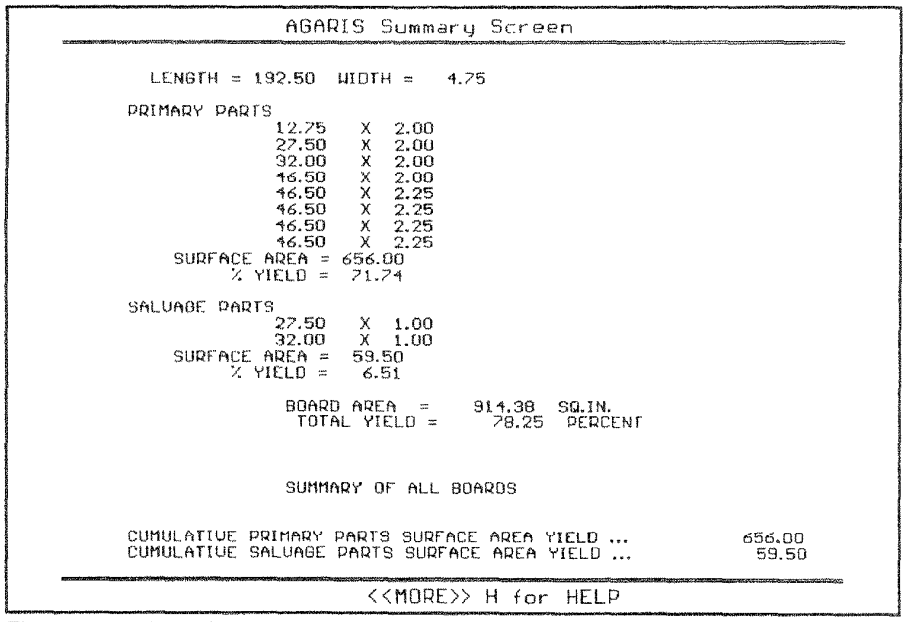
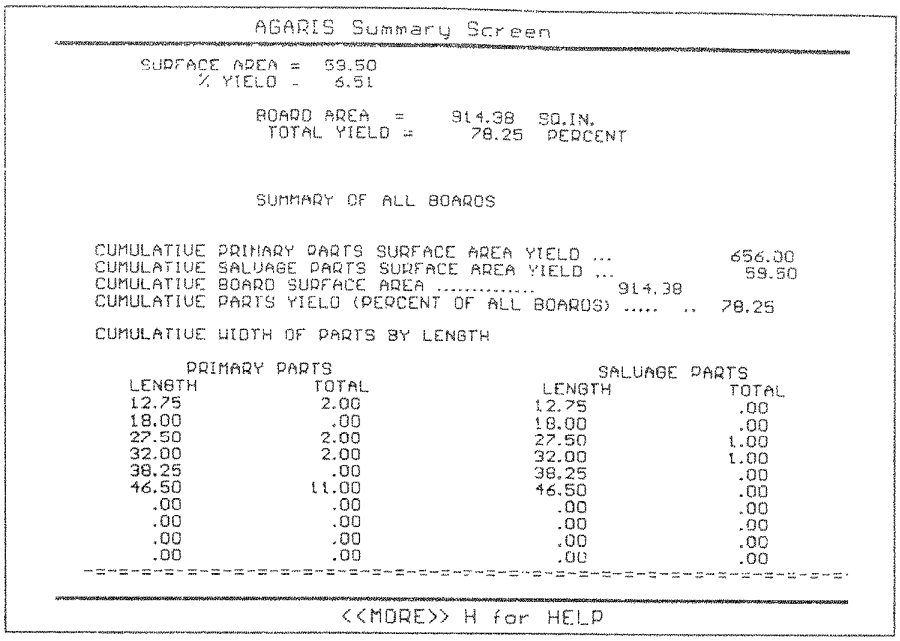


Figure 7.1C. Sample parts listing.

The PAGE-UP and PAGE-DOWN keys display the previous or next screen. There is a limit to the number of lines you can backspace. As a rule, you can never back up farther than the top of the previous screen. Press "X" to exit from the view screen and return to the summary program main menu. To print the summary tables, select "3" at the main menu. The computer will then display a selection of possible printers.

The selection menu is shown in Figure 7.1E. To print the parts listings, select "4" at the main menu, then follow instructions for printing the summary tables.



AGARIS Summary Screen

SURFACE AREA = 59.50
% YIELD = 6.51

BOARD AREA = 914.38 SQ.IN.
TOTAL YIELD = 78.25 PERCENT

SUMMARY OF ALL BOARDS

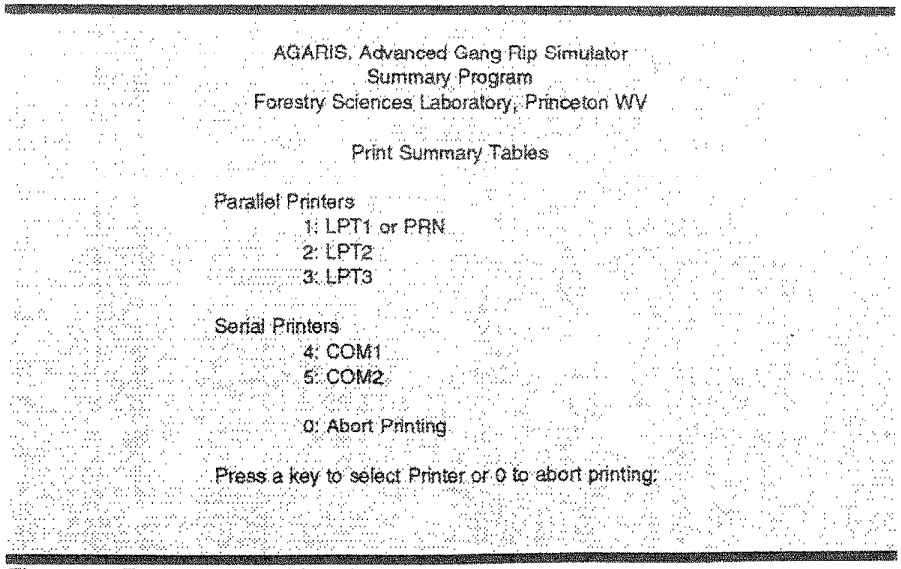
CUMULATIVE PRIMARY PARTS SURFACE AREA YIELD ... 656.00
CUMULATIVE SALVAGE PARTS SURFACE AREA YIELD ... 59.50
CUMULATIVE BOARD SURFACE AREA 914.38
CUMULATIVE PARTS YIELD (PERCENT OF ALL BOARDS) 78.25

CUMULATIVE WIDTH OF PARTS BY LENGTH

PRIMARY PARTS		SALVAGE PARTS	
LENGTH	TOTAL	LENGTH	TOTAL
12.75	2.00	12.75	.00
18.00	.00	18.00	.00
27.50	2.00	27.50	1.00
32.00	2.00	32.00	1.00
38.25	.00	38.25	.00
46.50	11.00	46.50	.00
.00	.00	.00	.00
.00	.00	.00	.00
.00	.00	.00	.00
.00	.00	.00	.00

<<MORE>> H for HELP

Figure 7.1D. Accumulated width of each length table



AGARIS, Advanced Gang Rip Simulator
Summary Program
Forestry Sciences Laboratory, Princeton WV

Print Summary Tables

Parallel Printers
1: LPT1 or PRN
2: LPT2
3: LPT3

Serial Printers
4: COM1
5: COM2

0: Abort Printing

Press a key to select Printer or 0 to abort printing:

Figure 7.1E. Summary table print menu.

Most computers use a single printer that is connected to the first line printer port, LPT1 or PRN. If this is the case with your computer, enter "1". Otherwise, you must determine how the printer is connected to the computer. You may want to refer to the manuals that came with your printer and computer. If you decide that you do not want to print the summary tables at this time, enter "0".

7.2 Plotting Boards and Their Gang Rip Solutions

The AGARIS program allows you to graph individual boards or all of the boards in a data file. To graph an individual board, select item "5" from the main menu. The board menu showing all of the boards in the datafile is then displayed. If all of the boards are not shown on the screen, press "N" or "P" to see the next or previous menu screen. To select a board, press "S" and then enter the desired board number. An example session showing the selection of board 119 from the data file TESTDATA.DAT is shown in Figure 7.2A.

```
                    AGARIS, Advanced Gang Rip Simulator
                              Summary Program
                    Forestry Sciences Laboratory, Princeton WV

                    The Current datafile contains the following boards

  7    13    37    119    167    156    260    468    532    573

  Press S: Select a Board; N: Next Screen; P: Previous Screen; X: Exit: S
                    Enter board number to graph: 119
```

Figure 7.2A. Board menu for individual board plotting.

Once a board is selected, it is immediately plotted on the computer screen. To plot each of the boards in a data file, select "6" from the summary program main menu (Fig. 7). You will then be presented each board in the order it appears in the data file. When the board is displayed, press "N" to see the next board. Press "X" to exit from both the individual and data file board graphing selections.

By default, boards are displayed on the screen with their defects and primary and salvage cuttings. A listing of the dimensions of the cuttings also is displayed. A screen showing the sample board, number 119, from the TESTDATA DAT datafile is shown in Figure 7.2B. The board rulers, shown in Figures 7.2B and 7.2C, allow you to determine the size of features within the board. The board-width ruler is in inches. The length ruler is marked every 6 inches with a longer mark every foot.

If viewing the board without the saw kerfs is desired, press "C" to remove the cuttings and the cuttings listing. Only the board outline and defects will be displayed. Note that AGARIS displays a transparent board, allowing defects from both sides to appear simultaneously on the screen. To make the cuttings reappear, press "C" once again. Figure 7.2C shows sample board 119 with the cuttings removed.

Figures 7.2B and 7.2C show a board being displayed in standard mode. In standard mode boards are displayed in 1:19 scale so that the entire board will fit on the screen. Standard mode further scales the boards by 200 percent in width. (The exact amount that boards are scaled depends on the type of display monitor being used. The scaling figures in this example were based on a VGA monitor where a 16-foot board is displayed in 10 inches.) By default, boards are displayed in standard mode.

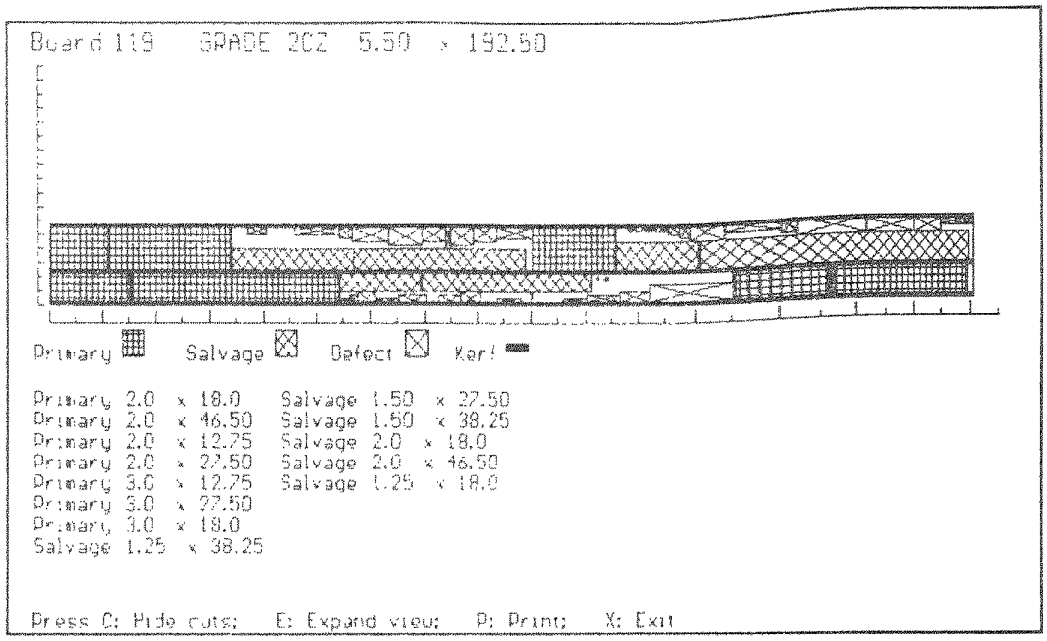


Figure 7.2B. Sample board with cuttings viewed in standard mode.

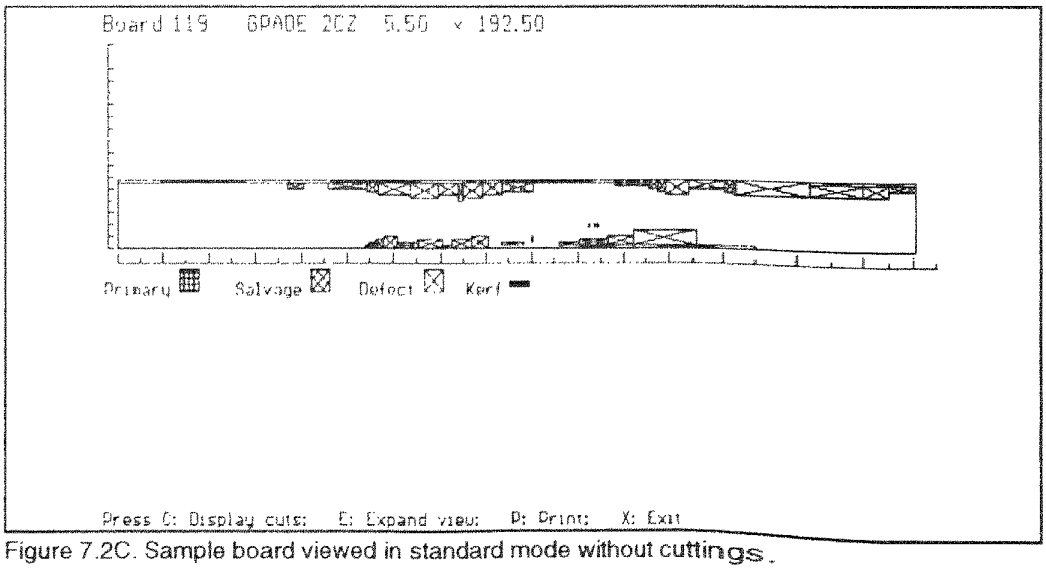


Figure 7.2C. Sample board viewed in standard mode without cuttings.

A board will be displayed in expanded mode if the "E" key is pressed. In expanded mode, boards are displayed in 1:5 scale with no additional width scaling. Thus, the boards are presented to scale. One drawback is that an entire board cannot be displayed on the screen at once. But if the left and right arrow keys are pressed, the view of the board can be panned to the left and right, allowing the entire board to be viewed in sequence. Pressing the HOME and END keys shows the leftmost and rightmost ends of the board. Figure 7.2D shows a board being displayed with its cuttings in expanded mode. In expanded mode, the cuttings also can be hidden and made to reappear by pressing the "C" key repeatedly. To return to the standard mode display, press the "E" key once again.

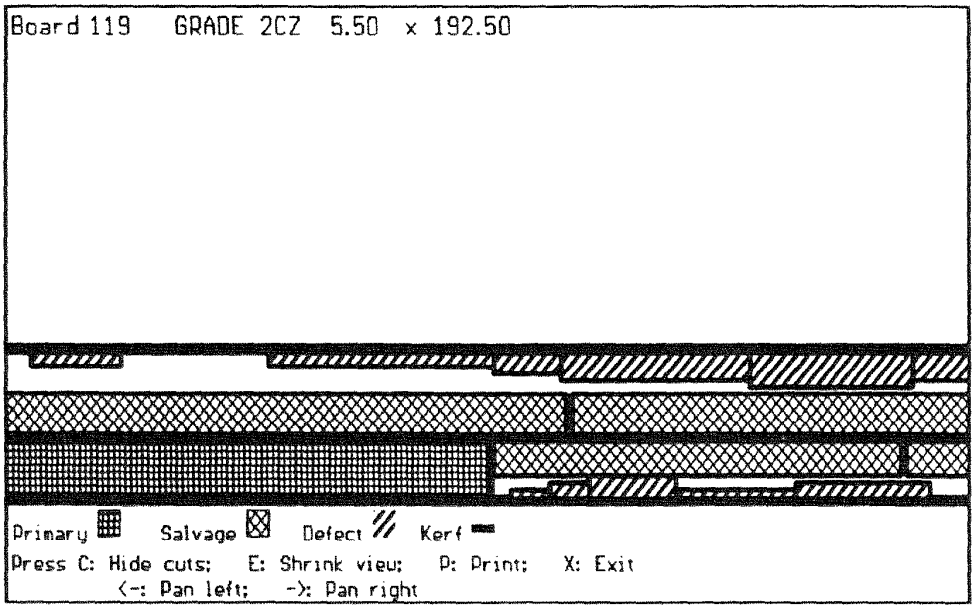


Figure 7.2D. Sample board with cuttings shown in expanded mode.

You may wish to print a board plot so that it can be examined later. Press "P" whenever a board is displayed on the screen. Note that printing the board will take several minutes. If you are using a laser printer, refer to the setup instructions for a laser printer in Appendix III. The appearance of the printed board is influenced directly by both the quality of the graphics available on the computer and the printer.

Important: If you are using a Hercules monochrome graphics adapter, you will not be able to print the boards as described because the MS-DOS GRAPHICS.COM printer support program does not support the printing of Hercules graphic images. Check the utilities disk and manuals that came with your adapter and monitor for a solution. If you have WordPerfect 5.0 or later, you can use the GRAB utility and print the screen images using WordPerfect.

7.3 Running Only the Summary Program

It is likely that you will choose not to view all of the boards or parts listings for a large run. The AGARIS summary program, DRAWBRDS.EXE, can be run at a later time as a stand alone program. You may find this useful if you first want to process several data files using the same cutting options list and then compare the results. There are two ways to run the summary program. For both methods, the working directory on the computer must be the directory that contains the AGARIS programs and data. If you accepted the default installation drive and directory, AGARIS is located in C:\AGARIS. To make this your working drive and directory enter:

C:

followed by:

CD \AGARIS

If you know the name of the data file that contains the boards and reports you wish to see, enter the name of the datafile (minus the extension) after the program name at the MS-DOS prompt. In this example, we want to see the results of the run that used the data file TESTDATA. To do this we enter:

DRAWBRDS TESTDATA

The computer will then display the summary program main menu (Fig. 7).

The second method requires only that the name of the program be typed at the MS-DOS prompt. To run the summary program in this manner we enter:

DRAWBRDS

The computer then looks for all the valid AGARIS output files. If the computer does not find one, an error is displayed and the program terminates. If the computer finds one or more data files, they are presented to you in the menu shown in Figure 7.3.

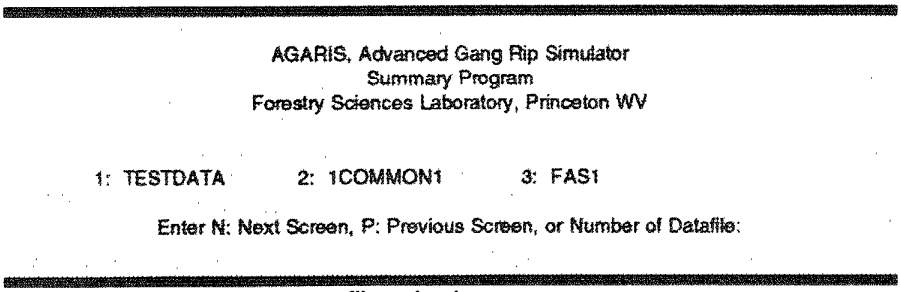


Figure 7.3. Summary program file selection menu.

To select a specific data file, enter the number of the data file at the prompt. If there are more data files, enter "P" and "N" to see the previous and next menu screens. Once you select a data file, the computer will display the summary program main menu shown in Figure 7. **You must select a data file to continue. If you wish to exit, select a data file and exit at the main menu.**

Literature Cited

Stern, A.K.; McDonald, K.A. 1978. Computer optimization of cutting yield from multiple ripped boards. Res. Pap. FPL 316. U.S. Department of Agriculture, Forest Prod. Lab., Madison, WI. 16p.

Hoff, Kristen G.; Adams, Edward L.; Walker, Elizabeth S. 1991. GR-151 PC program for evaluating gang-rip first cut-up procedures. Res. Pap. GTR-NE-156. U.S. Department of Agriculture, Forest Service, Northeastern Forest Experiment Station. 16p.

Gatchell, Charles J.; Wiedenbeck, Janice K.; Walker, Elizabeth S. 1992. 1992 data bank for red oak lumber. Res. Pap. NE-669. Radnor, PA. U.S. Department of Agriculture, Forest Service, Northeastern Forest Experimient Station. 47p.

National Hardwood Lumber Association. 1990. Rules for the measurement and inspection of hardwood and cypress lumber. Memphis, TN: National Hardwood Lumber Association.

Appendix I. AGARIS Data File Descriptions

This appendix describes the contents of the individual data files included in the AGARIS package. All data files have an eight letter primary file name followed by a ".DAT" extension. All the boards in each data file are one of four grades. The grade of lumber in a particular data file is determined by looking at the file name.

If the file name begins with	the grade is
FAS,	Firsts and Seconds.
SELECTS,	Selects.
1COMMON,	No. 1 Common.
2COMMON,	No. 2A Common.

The boards supplied with AGARIS are found in Tables 10, 11, 12, and 13 of the "1992 Data Bank for Red Oak Lumber." For No. 1 and No. 2A Common, each grade is subdivided into three quality subclasses that indicate the amount of surface measure contained in the grading cuttings. Minus is the low end of each grade and is 50 through 54 percent for No. 2A Common and 67 through 71 percent for No. 1 Common. Zero or midpoint is the middle of the grade and is 55 through 61 percent for No. 2A Common and and 72 through 78 percent for No. 1 Common. Plus is the high end of the quality range and is 62 percent and higher for No. 2A Common and 79 percent and higher for No. 1 Common. The grades specify only the minimum percentage required for each grade. There is no specific upper limit

The following tables show the total number of boards for each of the four grades. In addition, the number of plus, minus, and zero graded boards in each data file is listed for the No. 1 and No. 2A Common data files.

First and Seconds:

Data file name	Total boards
FAS1.DAT	67
FAS2.DAT	66
FAS3.DAT	66
Totals for grade	199

Selects:

Data file name	Total boards
SELECTS1.DAT	70
SELECTS2.DAT	70
SELECTS3.DAT	70
Totals for grade	210

No. 1 Common:

Data file name	Number of minus boards	Number of zero boards	Number of plus boards	Total boards
1COMMON1.DAT	12	21	42	75
1COMMON2.DAT	11	22	41	74
1COMMON3.DAT	17	26	31	74
1COMMON4.DAT	16	18	40	74
1COMMON5.DAT	19	25	30	74
1COMMON6.DAT	15	16	43	74
1COMMON7.DAT	11	28	35	74
1COMMON8.DAT	10	22	42	74
Totals for grade	111	178	304	593

No. 2A Common:

Data file name	Number of minus boards	Number of zero boards	Number of plus boards	Total boards
2COMMON1.DAT	9	18	46	73
2COMMON2.DAT	6	21	46	73
2COMMON3.DAT	12	16	45	73
2COMMON4.DAT	9	21	43	73
2COMMON5.DAT	11	24	38	73
2COMMON6.DAT	8	10	55	73
2COMMON7.DAT	10	20	42	72
2COMMON8.DAT	8	21	43	72
Totals for grade	73	151	358	582

Appendix II. Error Messages

This appendix lists the errors that are detected and reported by the AGARIS programs. Other errors (system errors such as "Insufficient Disk Space") are reported by your computer's operating system. The system errors will cause problems within the AGARIS programs. When this occurs, consult the documentation for your system to correct the problem.

AGR-001 WARNING - Encountered board wider than 16.5 inches.

Causes:

1) Input board data file describes a board wider than 16.5 inches. AGARIS will not process boards of this width, so this particular board will be skipped.

Action:

1) Remove the wide board from the data file.
2) No action is required.

AGR-002 WARNING - Board too long to process.

Causes:

1) Input board data file describes a board longer than 197.5 inches. AGARIS will not process boards of this length, so this particular board will be skipped.

Action:

1) Remove the long board from the data file.
2) No action is required.

AGR-003 WARNING - Board contains more than 200 defects.

Causes:

1) Input board data contains a board describing more than 200 defects. AGARIS will not process boards with an excess of 200 defects. This board will be skipped.

Action:

1) Remove the board from the data file.
2) No action is required.

AGR-04A WARNING - Board # too wide to process under existing arbor.

Causes:

1) The input board data file contains a board wider than the width of the arbor you have chosen. The overwidth of the board will be excluded from processing, possibly losing cuttings and reducing yield.

Action:

1) Increase the width sizes you have specified.
2) Modify the saw spacings to use more of the wider widths.
3) Use a variable arbor or floating outer blade instead of a fixed arbor.
4) Omit the board from the input data file.

Appendix II. Error Messages

This appendix lists the errors that are detected and reported by the AGARIS programs. Other errors (system errors such as "Insufficient Disk Space") are reported by your computer's operating system. The system errors will cause problems within the AGARIS programs. When this occurs, consult the documentation for your system to correct the problem.

AGR-001 WARNING - Encountered board wider than 16.5 inches.
Causes:

1) Input board data file describes a board wider than 16.5 inches. AGARIS will not process boards of this width, so this particular board will be skipped.

Action:

1) Remove the wide board from the data file.
2) No action is required.

AGR-002 WARNING - Board too long to process.
Causes:

1) Input board data file describes a board longer than 197.5 inches. AGARIS will not process boards of this length, so this particular board will be skipped.

Action:

1) Remove the long board from the data file.
2) No action is required.

AGR-003 WARNING - Board contains more than 200 defects.
Causes:

1) Input board data contains a board describing more than 200 defects. AGARIS will not process boards with an excess of 200 defects. This board will be skipped.

Action:

1) Remove the board from the data file.
2) No action is required.

AGR-04A WARNING - Board # too wide to process under existing arbor.
Causes:

1) The input board data file contains a board wider than the width of the arbor you have chosen. The overwidth of the board will be excluded from processing, possibly losing cuttings and reducing yield.

Action:

1) Increase the width sizes you have specified.
2) Modify the saw spacings to use more of the wider widths.
3) Use a variable arbor or floating outer blade instead of a fixed arbor.
4) Omit the board from the input data file.

AGR-008 ERROR - More than 410 sawcuts.

Causes:

1) AGARIS is limited to not more than 410 sawcuts per board. Under current setup options, a particular board has exceeded this limit.

Action:

1) Alter cutting sizes.
2) Alter arbor type.
3) Remove this particular board from the data file.

AGR-009 WARNING - More than 100 data files. Will display first 100 only.

Causes:

1) There are more than 100 data files in your AGARIS work directory. The AGARIS routines cannot work with more than 100 files.

Action:

1) Delete or move files from past runs to a different subdirectory.

DRW-001 ERROR - Unable to open specified dictionary filename. Program terminating.

Causes:

1) A nonexistent or incorrect dictionary file name was specified.

Action:

1) Check the spelling of the dictionary file name. Be sure you are not specifying the extension (.DCT).
2) Check to make sure the specified file actually exists.

DRW-002 ERROR - Unable to open plot file XXXXXXXX, board plots will be unavailable.

Causes:

1) A nonexistent or incorrect plot file name was specified in the dictionary file.

Action:

1) Check to make sure a plot file with the same primary name as the dictionary file exists. If the plot file does not exist, then the data file must be analyzed again by AGARIS to generate the plot file. For example, If you are using the file 1COMMON1, then the file 1COMMON1.PLT must exist to enable the board plots to be viewed.

DRW-003 WARNING - More than 100 dictionary files. Will use first 100 only.

Causes:

1) There are more than 100 dictionary files in your AGARIS work directory. The AGARIS routines cannot work with more than 100 files.

Action:

1) Delete or move files from past runs to a different subdirectory.

DRW-004 ERROR - No dictionary files (*.DCT) were found. Program terminating.

Causes:

1) No dictionary file was specified, the default dictionary file, DICTNRY, was not found, and no files with a .DCT extenstion were found.

Action:

1) Make sure you are working in your AGARIS work directory.
2) Refer to Sections 1 through 5 of this user's manual and perform an AGARIS run.

DRW-005 ERROR - Unable to open dictionary file XXXXXXXX.

Causes:

1) No dictionary file was specified, the default dictionary file, DICTNRY, was not found, and no files with a .DCT extenstion were found.

Action:

1) Make sure you are working in your AGARIS work directory.
2) Refer to Sections 1 through 5 in the user's manual and perform another AGARIS run.

DRW-006 ERROR - NNNN is an invalid board number.

Causes:

1) When selecting a board to be plotted, you entered a board number that is not in the data file being examined.

Action:

1) Enter a valid board number from the valid ones displayed on the screen.

DRW-007 ERROR - Unable to open file XXXXXXXX. Report/Summary report unavailable.

Causes:

1) A nonexistent or incorrect summary or report file name was specified in the dictionary file.

Action:

1) Check to make sure both a summary file with the extension .SUM and a report file with the extension .RPT have the same filename as the dictionary file being used. For example, If you are using the file 1COMMON1, the files 1COMMON1.RPT and 1COMMON1.SUM must exist to enable the summaries and reports to be viewed.

DRW-008 ERROR - Memory allocation error prevents viewing of report.

Causes:

1) Summary program running under one or more other programs.
2) Memory resident programs interfering with the summary program.
3) Computer has insufficient memory.

Action:

1) Run AGARIS or DRAWBRDS directly from the MS-DOS prompt.
2) Reboot the computer without loading any TSR (terminate and stay resident) programs.

INP-001 ERROR - Your maximum length is shorter than your minimum length.

Causes:

1) The maximum length value entered in the setup options is smaller than the value entered for the minimum length for the random cutting-length settings.

Action:

1) Alter the value for either minimum length or maximum length.

INP-002 ERROR - You have specified at least one pair of ranges that exclude one or more cuttings. Please change your ranges so that no possible cuttings will be omitted.

Causes:

1) There is a gap in the range span in which a potential cutting size could fall, omitting it from the summary tables.

Action:

1) Alter the ranges so that the difference between ranges does not include a multiple of 0.25.

INP-003 ERROR - You have specified length/width ranges that overlap. Ranges are defined to be inclusive.

Causes:

1) There are two or more ranges in which a possible length/width size may be included.

Action:

1) Modify range values so that beginning and ending values are not shared between successive ranges.

INP-004 ERROR - Your length/width ranges have an invalid upper or lower range value.

Causes:

1) Ranges are not declared small enough to capture all length/width sizes.
2) Ranges are not declared large enough to capture all length/width sizes.
3) Cutting minimum/maximum sizes were modified since ranges were declared.

Action:

1) Modify ranges or add ranges so that no cuttings are omitted from the summary tables. The range modification screen will prompt you for the upper and lower range expectations. These are based on the minimum and maximum cutting sizes.

INP-006 ERROR - You entered an invalid part width number. Reenter this spacing.

Causes:

1) A value other than 1 thru 6 was entered for a saw spacing.

Action:

1) Refer to the corresponding numbers for each part width previously declared. AGARIS expects a reference number (1 through 6) instead of the actual width value to be entered for a saw spacing.

INP-007 ERROR - You have specified at least one invalid range. Please check to see that your ranges meet the above requirements.

Causes:

1) Ranges have not been declared small enough or large enough to capture all possible cutting sizes.

2) Successive ranges have gaps that may allow potential cuttings to be excluded from the summary tables.

3) Ranges may overlap such that a cutting size would fall into two or more ranges.

Action:

1) Add or modify ranges so that no potential cutting sizes will be omitted and each range describes a unique set of cuttings.

INP-008 ERROR - You have specified at least one pair of ranges that exclude one or more cuttings. Please change your ranges so that no possible cuttings will be omitted.

Causes:

1) There is a gap in the range span in which a potential cutting size could fall, omitting it from the summary tables.

Action:

1) Alter the ranges so that the difference between ranges does not include a multiple of 0.25.

RPT-001 ERROR - RPTFMT (report formatter program) could not find the dictionary file. Paged output reports will be unavailable for this run.

Causes:

1) All of the necessary files for the report formatter program, RPTFMT.EXE, will not exist if RPTFMT is run any other time than in an AGARIS run.

2) An earlier error may have prevented the creation of the dictionary file.

Action:

1) Run AGARIS again. Pay special attention to any errors that occur before this one. It is likely that these errors will identify the true problem.

RPT-002 ERROR - Report Formatter unable to open report file. Reports will be unavailable for this run.

Causes:

1) The parts report file generated by AGARIS could not be found. An earlier error may have prevented the creation of the report file.

Action:

1) Run AGARIS again. Pay special attention to any errors that occur before this one. It is likely that these errors will identify the true problem.

RPT-003 ERROR - Report Formatter unable to open output file.
Paged reports will be unavailable for this run.

Causes:

1) The output file for the formatted report could not be opened. This could be due to insufficient space on the hard disk or to a write-protected file with the same name as the output file.

Action:

1) Check for sufficient space on the hard disk.
2) Look for a file with the same primary name as the data file being examined but with a .TMP extension. Delete this file and run AGARIS again.

RPT-004 ERROR - Report Formatter unable to open cumulative totals file.
Cumulative yield totals will be unavailable on reports.

Causes:

1) The file that contains the cumulative totals for this AGARIS run cannot be found. An earlier error may have stopped the AGARIS program, preventing the creation of the totals file.
2) All of the necessary files for the report formatter program, RPTFMT.EXE, will not exist if RPTFMT is run any other time than in an AGARIS run.

Action:

1) Run AGARIS again and look for error messages that occur before this one. They will likely identify the true problem.
2) Do not run RPTFMT outside of an AGARIS run.

RPT-005 ERROR - Report Formatter unable to open NNNNNNNN.EEE for appending the cumulative yield totals. Totals will be unavailable.

Causes:

1) The specified report or summary file could not be found. An earlier error may have prevented the creation of this file.

Action:

1) Run AGARIS again. Pay special attention to any errors that occur before this one. It is likely that these errors will identify the true problem.

APPENDIX III. Laser Printer Configuration

Beginning with MS-DOS version 5, Microsoft Corporation began supporting the printing of graphic screens to laser printers. Previously, only dot matrix and thermal printers were supported. For AGARIS to use the laser printer successfully you must do the following:

1. Determine the type of the laser printer and any current emulation settings.

2. Refer to the GRAPHICS command in your MS-DOS version 5.0 reference guide, or on-line help in MS-DOS version 6.0 and later. Read the documentation for the GRAPHICS command and determine the correct printer driver for your printer type.

3. After you have determined your printer type, you must use a text editor to edit the AGARIS.BAT file to allow plotting to your laser printer. For the following example we are changing the AGARIS.BAT file to allow plotting to a standard HP Laserjet II printer or a laser printer capable of emulating a HP Laserjet II printer. In this example we are using the EDIT text editor supplied with MS-DOS versions 5 and 6. Perform the following steps to make the necessary changes:

   i) Make the working directory the same directory that contains the AGARIS programs and data. To do this, type at the MS-DOS prompt: (Assuming a default installation)

   ```
   C:
   CD \AGARIS
   ```

   ii) Edit the AGARIS.BAT file by entering:

   ```
   EDIT AGARIS.BAT
   ```

   iii) Move the cursor to the end of the line that reads:

   ```
   GRAPHICS
   ```

   Specify the correct laser printer type at the end of this line. To specify the HP Laserjet II, edit the GRAPHICS line so that it looks like:

   ```
   GRAPHICS LASERJETII
   ```

   iv) Exit the Editor and save the edited AGARIS.BAT file. To do this using the MS-DOS EDIT editor, hold the ALT key down and press F, press the X key, press Y to answer "YES, save this file".

You are now able to print graphics screens to the laser printer.