List of Features in EES by version number and date

Versions 6.585 8/25/02
Right-clicking in the header cell of a table column brings up a pop-up menu with Properties as one of the menu choices. Selecting Properties will now display the Sum, Average, and Std. Deviation of the values in the selected column, in addition to the units, format, and other information related to the column.

Version 6.581 8/19/02
The $Bookmark directive provides a means of quickly moving to selected locations in the Equations and Formatted Equations windows. The bookmarks can be accessed from the lower part of the Search menu and the popup menu that appears when the right mouse button is pressed. Several bookmarks have been added to this file, for illustration.

Version 6.575 8/05/02
The $TABSTOPS directive allows up to 5 tab stop positions to be set. These tab positions affect the appearance of text in the Equations window. In addition,up to 5 default tab stop positions can be set in the Equations tab of the Preferences dialog in the Options menu. The $TABSTOPS directive overrides the setting made in the Preferences dialog. The $TABWIDTH directive is superceded by the $TABSTOPS directive, but it is still accepted.

Version 6.573 8/04/02
Formally, error bars could be drawn on plots only for variables involved in the Uncertainty Propagation Table command. Now, error bars can be placed on any plot by clicking on the X-axis or Y-axis check box in the Error Bars box of the Modify Plot dialog. The Modify Plot dialog is presented when the user right-clicks in the plot rectangle or when Modify Plot is selected from the Plot menu.

Version 6.568 7/29/02
Property data for Deuterium have been implemented.

Version 6.566 7/27/02
Functions SUMLOOKUP and AVGLOOKUP have been added.

Version 6.564 7/25/02
Functions SUMPARAMETRIC and AVGPARAMETRIC have been added to sum or average the values in all or selected rows in a specified column of a specified Parametric Table. The online help provides the syntax for these functions.

Version 6.561 7/19/02
The Solution window is accessible after the Solve command is issued even if the solution is not attained. In this case, however, some variables are not evaluated. The variables that are not evaluated are now shown in gray color in the Solutions window.

Version 6.552 6/27/02
If EES is launched from the command line with the /NOSPLASH parameter, the splash screen will be skipped, as in the following example:
C:\EES32\EES.exe C:\EES32\HELLO.ees /NOSPLASH

Version 6.547 6/21/02
A short (up to 255 character) description of the contents of a plot window plot to be entered in the Plot Setup dialog. The description can be printed with the plot.

Version 6.543 6/19/02
A Calculator window has been added, accessed from the Windows menu. The Calculator window evaluates one-line expressions involving numbers, existing EES variables or any of the built-in functions. See the online help for details.

Version 6.538 6/12/02
Variable information can be used to set the units and display format of variables in internal Functions and Procedures, in addition to those in Modules, Subprograms, and the Main Program.

Version 6.533 6/06/02
Error messages that are displayed when EES cannot converge to a solution have been improved and linked to Variable Information for the variables that are causing the convergence problems.

Version 6.530 5/29/02
EES plots can now be saved in a separate file in bitmap (*.bmp), jpeg (.jpg), picture (*.wmf) or enhanced metafile (*.emf) formats by right-clicking on the plot tab and then clicking the Save button.

Version 6.527 5/25/02
Text items placed in the plot windows can contain up to 240 characters (previously 80) and have more than one font applied to selected parts. A single text item can also span multiple lines. The formatting is facilitated by speed buttons in the Format Text dialog that appears when you double click or right click on a text item in the plot window.

Version 6.516 5/11/02
Tabs on the plot and table windows can be given a background color by right-clicking on the tab.

Version 6.514 5/08/02
A line of descriptive text with up to 255 characters can be entered for each plot window and for each Parametric and Lookup table by right-clicking on the tab at the top of the window. The text can optionally be printed when the table or plot is printed.

Version 6.504 4/28/02
The Windows menu now provides submenus for the Plot window and for the Parametric and Lookup tables if more than one plot or table is contained in the window.

$Bookmark Version 6.501
Version 6.501 and 6.502 4/23/02
The operation of the Variable Information dialog has been changed. Calculated values of variables were displayed in place of the guess values if the value was previously determined. Now the guess value is always displayed. However, right clicking in the Guess column will change the display from Guess values to current values. Provisions have been made to copy cells in this dialog to other cells more easily. For example, a 'drag box', similar to that used in EXCEL has been implemented to allow the contents of a cell to be copied to a range of cells above or below it. See the online help for details.

Version 6.498 4/18/02
Right-clicking on the row column in a Parametric or Lookup table will bring up a popup menu that allows rows in the table to be inserted or deleted. It is now possible to control the number of rows that are inserted by selecting the number that you wish to insert. Selection of rows can be made by holding the mouse button down and dragging it to a new position in the row column.

Version 6.497 4/17/02
After calculations are completed, selecting a variable in the Equations window will cause its value and units to be displayed in a 'hint' window below the cursor. The variable can be easily selected by double-clicking. This capability makes it unnecessary to refer to the Solutions window to determine values of EES variables.

Version 6.490 4/09/02
Thermodynamic and transport properties for cyclohexane have been added.

Version 6.489 4/07/02
The 'hot area' that brings up a child Diagram window when it receives a mouse click can be moved with arrow keys in development mode if the Ctrl-Shift keys are depressed and the mouse cursor is positioned in the red-dotted rectangle that displays the boundary of the hot area.

Version 6.485 4/04/02
Unit checking for selected equations can be disabled in the Residuals window or in the Check Units window by right-clicking on the equation and selecting Disable Unit Checking from the pop-up menu.

Version 6.480 3/30/02

Differentiate1 and Differentiate2 commands have been added that use linear and quadratic interpolation, respectively, in estimating a derivative.

Version 6.476 3/26/02
Tabs can now be set in the Diagram window formatted paragraph text. The width of this text can be set to grow or shrink with the width of the Diagram window.

Version 6.467 3/18/02
Property data for HFE7100 have been added.

Version 6.461 3/11/02
Units raised to a fractional power are now recognized, e.g., [ft^(2/3)]

Version 6.454 3/01/02
The GAMMA_ function has been added as a built_in mathematical function.

Version 6.450 2/23/02
The uncertainty values used in the Uncertainty Propagation and Uncertainty Propagation Table commands can now be supplied as numerical constants or as EES variables. In the Uncertainty Propagation Table command, the EES variable must have specified values appearing in the Parametric table.

Version 6.446 2/20/02
The Uncertainty function has been renamed to UncertaintyOf and its capabilities have been improved.

Version 6.444 2/18/02
The Warnings menu item in the Windows menu will produce a display of all warnings issued during the last calculation.

Version 6.440 2/15/02
The % of uncertainty in a calculated variable resulting from the uncertainty in each measured variable is displayed in the Solution window after the Uncertainty Propagation or Uncertainty Propagation Table calculations are completed.

Version 6.430 2/2/02
The units of an external function can be set, as in the following simple example.

```
Function TK(TC)
    TK=TC+273.15 "[K]"
    end
```

Function TK can be saved in a .LIB file in the USERLIB directory. It will be read in automatically when EES is started. When called, the function will return a value having units of K. The Solid/Liquid property functions use this capability.

Version 6.425 1/28/02
Substance Ice provides the same properties as Steam, Steam_NBS, Water and R718 except that it will return the state corresponding to a lower temperature when two solutions are possible, as in the following example.

```
T_ice=temperature(Ice,v=1.088e-3,x=0)          {T_ice=-16.85 [C]}
T_steam=temperature(Steam,v=1.088e-3,x=0) {T_steam=147.8 [C]}
```

Version 6.424 1/28/02
The tab spacing in the Equations and Formatted Equations windows can be changed in the Preference dialog (Equations tab) or with the $TabWidth directive.

Version 6.423 01/24/02
Substance Steam will return properties for ice for temperatures below 273.15 and pressures above the saturation vapor pressure of ice. Note that substance Steam_IAPWS will not provide ice properties.

Version 6.421 01/22/02
A Retry button and other improvements have been added to the Curve Fit dialog for a user-entered functional form.

Version 6.419 01/21/02
Property data for refrigerant R-508B (DuPont SUVA 95) have been implemented.

Version 6.418 01/20/02
The Unit System dialog provides additional options when SI units are selected. Pressure can be in Pa, kPa, bar, or MPa units. Energy units can be in Joules or kJoules.

Version 6.412 01/10/02
In the Professional version, the information in drop-down lists that appear in the Diagram window can be read from a file.

Version 6.410 01/01/02
Psychrometric charts produced with the Property Plot command now offer the option of constant specific volume lines.

Version 6.406 12/21/01
The default reference state for R134a has been set to the ASHRAE reference. Steam_IAPWS is now accessible in the academic version.

$Bookmark Version 6.402
Version 6.402 12/16/01
Fluids R22, R134a, Ammonia, and Propane have been renamed to R22_old, R134a_old, Ammonia_old, and Propane_old, respectively. Fluids R22_ha, R134a_ha, Ammonia_ha, and Propane_ha have been renamed to R22, R134a, Ammonia, and Propane, respectively. This change now results in the high accuracy property formulation for these fluids being the default. R717 is equivalent to Ammonia, and R290 is equivalent to Propane.

The $Reference directive allows the reference state for enthalpy and entropy for fluids with properties determined using the high accuracy equation of state to be set. See the Fluid Property Information in the online help to determine which fluids are represented by high accuracy equations of state. The available settings are DFT (default), NBP (set enthalpy and entropy to 0 for saturated liquid at the normal boiling point), ASH (set enthalpy and entropy to 0 for saturated liquid at -40°C (°F)) and IIR (set enthalpy=200 kJ/kg and entropy=1 kJ/kg-K for saturated liquid at 273.15 K). See the online help for $Reference for more details.

Version 6.395 12/10/01
Holding the Shift and Ctrl keys down while the cursor is positioned on a plot produced with the Property Plot command now shows
all thermodynamic properties corresponding to the state at the cursor position in the window caption.

The OverlayPlot and NewPlot Macro commands can specify SymbolSize

The PropertyPlot macro command allows the pressure to be specified for psychrometric plots.

Version 6.386 12/01/01
The Print command can now select individual tabbed Solution windows for printing.

Version 6.385 11/30/01
The unit checking algorithms will now accept units raised to fractional powers, e.g., [K^0.5]"

Version 6.384 11/29/01
Units in Functions and Procedures in the Solution window are shown in alphabetical order.

Version 6.380 11/26/01
Unit checking will now occur for equations in Functions and Procedures. Units for variables in Functions and Procedures can be entered either as a comment in the Equations window or by right-clicking on the variable in the Solution window. Note that the variables in Functions and Procedures will not be displayed in the

Solution window unless the "Show Function/Procedure/Module values" checkbox in the Options tab of the Preferences dialog is enabled or a $LOCAL ON directive appears in the Equations window.

Version 6.374 11/17/01
The speed button bar below the menus now provides a button to access the Residuals window.

If Automatic unit checking is set in the Preferences dialog or with the $CHECKUNITS directive, the Solution window will indicate the number of equations that fail the unit checking test. The Residuals window will display a column indicating whether the units for each equation check. Right clicking on an equation in the Residual window will bring up a popup menu. One of the menu options is to display the message from the unit checking processor.

Version 6.370 11/13/01
The $CHECKUNITS ON/OFF overrides the automatic unit checking setting in the General tab of the Preferences dialog.

Version 6.361 11/04/01
The Convert function will accept unit groups in parentheses raised to a power, as in the following:
X=convert((m/s)^2,kJ/kg)

Version 6.353 10/27/01
A dot, bar or hat can be placed over a selected character(s) on plot text items. The procedure is to first select the character(s) and then press and hold the symbol speed button while sliding the mouse to the X_dot, X_bar or X_hat symbol in this pop-up palette.

Version 6.351 10/23/01
Fugacity has been added to the built-in thermophysical properties functions.

Version 6.346 10/17/01
High accuracy thermodynamic and transport property data for xenon have been implemented.

Version 6.343 10/15/01
High accuracy thermodynamic and transport data for air have been implemented. In the two-phase region, the saturation temperature of air varies with quality at a given pressure.

Version 6.342 10/11/01
High accuracy thermodynamic and transport property data for R125 (pentafluoroethane) have been implemented.

Version 6.337 10/03/01
The $SumRow On/Off directive allows the visibility of the sum row in Parametric tables to be controlled from the Equations window. The values in the sum row can now be copied to the clipboard.

Version 6.330 9/22/01
Latex Solution and Table windows can now display background colors.

Version 6.310 8/26/01
The $Private directive has been implemented to prevent external routines from been seen from in the Function Information dialog. The online-help provides details.

Version 6.303 8/18/01
A column of strings from the Parametric, Lookup or Arrays table can be selected as the X-axis variable for X-Y and bar plots. The X-axis will then display the strings rather than numerical values.

$Bookmark Version 6.300
Version 6.300 8/15/01
Surface tension correlations have been implemented for blends R404A, R407C, R410A, and R507C.

Version 6.298 8/14/01

The Uncertainty Propagation dialog has been modified to allow additional variables to be included as "Measured" variables. See the on-line help for details.

Version 6.295 8/11/01
The Interpolate2D function provides interpolation as function of two independent variables using a radial basis functions. Details are available in the on-line help. An example is provided in the Interpolate function menu item of the Examples menu.

Version 6.294 8/08/01
Transport property data for Helium have been extended and improved.

Version 6.290 8/05/01
Right-clicking the tab on Lookup and Parametric table windows displays a dialog with table properties. A duplicate button has been added to this dialog to facilitate making copies of tables.

Version 6.284 7/28/01
$Include directives may be used in drop-down string lists in the Diagram Input to selectively add EES equations that depend on a user choice. This capability eliminates the 255 character limitation on the number of equations that can be entered from the Diagram window. An example titled "Using the Diagram Input capability with $Include files" is available from the Examples menu with the Diagram Window menu item.

Version 6.280 7/27/01
The New Parametric Table dialog now provides a check box to show or hide array variables from the list of variables that can be selected to include in the table.

Version 6.277 7/24/01
SoundSpeed has been implemented for substances Water, Steam, and Steam_NBS.

Version 6.274 7/22/01
Warnings are issued if the Interpolate, Interpolate1, or Interpolate2 functions are applied to extrapolate data. The warning message list is cleared during each iteration so that warning generated as a consequence of intermediate results are no longer displayed. The LookupCellEmpty function has been implemented.

Version 6.270 7/19/01
The Function Information command now provides a Solid/Liquid properties button to allow more convenient access to the temperature-dependent properties of solids and liquids implemented in the Solid-Liquid library package.

Version 6.265 7/13/01
Controls are now provided to show or hide array variables in the Min/Max dialog.

Version 6.262 7/10/01
Array range notation with variable limits is now supported in Function and Procedure header statement. For example, EES accepts,

```
Function TEST(n, X[1..n], y)
```

In this case n is assigned a default MAXIMUM value of 100. The calling program must provide the maximum or fewer elements in the array. To increase the maximum, change the n in 1..n to the desired maximum. See the online help under Array Range Notation for details.

Version 6.260 7/08/01
Formatted text can be placed in the Diagram and Child Diagram windows in the Professional version. Formatted text can include paragraphs or tables copied from other applications. EES variable information can be inserted into the formatted text item. See the online-help and the example file in the Diagram menu item of the Examples menu for details.

Version 6.254 7/01/01
The algorithms invoked with the Check Units command can now evaluate equations that have variables raised to fractional powers.

Version 6.252 6/29/01
Richardson extrapolation is now optionally provided for integration with a fixed step size. The option can be set on the Integration tab of the Tolerances dialog in the Options menu. The on-line help provides additional information.

Version 6.247 6/17/01
Property function ACENTRICFACTOR requires one argument which is the name of the fluid. It returns the acentric factor for that fluid.

Version 6.245 6/16/01
Copying and pasting large amounts of data to any of the EES tables was previously very slow. This problem has now been rectified.

Version 6.243-4 6/14/01
The temperature range for the ideal gas transport properties of air, H2, O2, N2, CO2, CO, and CH4 have been extended.

Version 6.239 6/09/01
Data in the Parametric and Lookup tables can be sorted in ascending or descending order by right-clicking in the column header cell and selecting Sort from the pop-up menu.

Version 6.235 5/30/01
The $LOCALVARIABLES ON/OFF directive controls the display of local variables (in Functions, Procedurses, Modules, and Subprograms) in the Solution and Residuals windows. This directive overrides the setting in the Preferences dialog.

Version 6.234 5/29/01
It is now possible for a Function or Procedure to call a Subprogram. A Subprogram is a stand-alone EES routine that can be accessed with the CALL statement. Functions and Procedures can use logic statements. The ability of Functions/Procedures to call a Subprogram increases the range of problem types that EES can solve. See the online help for details.

Version 6.231 5/26/01
In the Residuals window, bold block numbers are used to identify equations that were not solved to the specfied tolerance.

Version 6.226 5/22/01
Ideal gas property data for C2H5OH (ethanol) have been implemented.

Version 6.224 5/21/01
3-D plotting has been implemented for the Professional and academic versions. See the online help (topic X-Y-Z plot) for details.

Version 6.220 5/14/01
An option to specify specific pages or a page range has been implemented in the Print dialog.

Text and objects drawn (or imported) in a Plot window can be copied to the Plot window of another instance of EES. Objects (e.g, lines, boxes, pictures) can be copied to/from the Diagram windows.

Version 6.218 5/12/01
When using the Uncertainty Table command, the sum row in the Parametric table will display the uncertainty of the summed values which is the square root of the sum of the squared uncertainty values from each row.

Version 6.213 5/03/01
The Modify Plot dialog now permits the size of major and minor ticks in Plot windows to be changed.

Version 6.212 4/29/01 and 02/20/02
An UNCERTAINTYOF function has been implemented to return the specified or calculated uncertainty for the variable provided as the argument to the function. For example, RUX=UncertaintyOF('X')/X will set the value of RUX to the relative uncertainty for variable X. The UNCERTAINTYOF function will return a non-

zero value only when the Uncertainty Propagation or Uncertainty Propagation Table commands (Calculate Menu) are used.

Version 6.210 4/26/01
It was necessary to change the calling parameters of the .DLF and .DLP external routines so that these types of dynamic link library files can be written in C++ (which no longer supports the long double format). All of the .DLF and .DLP files in the USERLIB folder have been updated. You will have to modify any .DLF or .DLP files you have composed. See the on-line help for External Functions and External Procedures for details.

Version 6.209 4/24/01
A Library Manager has been implemented in the Professional version. The Library Manager controls which files are automatically loaded from the USERLIB folder when EES is started. Access to the Library Manager is from the Function Info command by pressing the Auto Load button when either EES Library Routines or External Routines is selected.

Version 6.208 4/22/01
Circles and rectangles that are drawn on the plot or diagram windows can now be transparent.

Version 6.205 4/19/01
In some situations, it is necessary to fill a column in then Lookup or Parametric table with values having a pattern of some type. For example, you may wish to enter 1, 2, 3, 4, and 5 in the first 5 rows of the column and then repeat these values in the next five rows and so on down the table. Alternatively, you may wish to enter 1, 1, 1, 1, 1 in the first 5 rows followed by 2, 2, 2, 2, 2 in the next five rows and so on. The capability to enter these pattern types is now provided in the dialog that appears when you click on the triangular icon in the upper right corner of the column header cell.

$Bookmark Version 6.200
Version 6.200 4/12/01
Examples are now accessible from the Examples Menu. You can remove this menu by moving the Examples folder out of the USERLIB folder.

Version 6.194 4/04/01
A plot can be duplicated by right-clicking on the tab at the top of the window. A dialog window appears with a duplicate button. The duplicate plot provides an easy way to create a plot template so that all of your plots have the same appearance.

Version 6.186 3/26/01
Integral tables can now be created in the LaTeX/PDF report.

Version 6.185 3/24/01
If a single file contains multiple EES library or external routines, that file will appear as an expandable folder in the Function Info dialog window, making it easier to locate the routine and access its information. For example, the 90 functions and procedures appearing in the SETP.LIB file (supporting the Solar Energy Thermal Processes textbook by J.A. Duffie and W.A. Beckman) appears as a single folder item in the list until it is expanded.

Version 6.184 3/22/01
Help for external functions and procedures loaded at startup or manually with the Load Library command is now provided in the Help menu.

Version 6.181 3/20/01
Thermophysical properties (density, specific heat, thermal conductivity, viscosity, and volumetric coefficient of expansion) as a function of temperature for many substances are now provided in the ThermoPhysical_Prop.lib library file. For example, the density and specific heat of copper at 300 K can be obtained using:
rho=rho_('Copper,300)
c=c_('Copper,300)

Version 6.181 3/16/01

Improved thermodynamic and transport property information has been implemented for R123.

Version 6.179 3/13/01
A limitation on the auto-update plotting option has been that the number of data points that are plotted had to be constant. This limitation is removed with an option (accessed by pressing the DATA button in the Modify Plot dialog) that will plot all rows of data in the selected table.

Version 6.177 3/10/01
Property data for ideal gas n-Hexane (C6H14) and n-Octane (C8H18) have been added.

Version 6.172 3/05/02
Ideal gas property data for acetylene (C2H2) have been added. Transport property information for NO and NO2 are now available.

Version 6.168 02/28/01
The critical property routines, T_crit, P_crit, and v_Crit, are now implemented for ideal gas substances.

Version 6.166 02/25/01
Multiple plots can be selected in the Modify Plot command by holding the Shift key down while clicking (or dragging) the mouse in the plot line list. If a change is made to a parameter, that change will be applied to all selected plots when the Apply or OK button is clicked. This capability makes it easy to, for example, change the size of the symbols for all plots at one time.

Version 6.165 02/24/01
The output stepsize in the $IntegralTable directive will accept a variable name in addition to a numerical constant.

Version 6.163 02/22/01
If the stepsize in the equation-based integral function is identically 0, automatic step size adjustment will be used in the integration, just as if a stepsize were not provided.

Version 6.160 02/18/01
The crosshair cursor on the Plot Windows is now accessed by pressing both the Shift and Ctrl keys. Just pressing the Ctrl key, as the crosshair cursor was formerly implmented, interfered with copy and paste operations on the Plot Window.

Version 6.157 02/15/01
High accuracy property data for n-hexane have been added to the data base.

Version 6.151 02/03/01
Property data for CarbonMonoxide have been implemented.

It is now possible to copy objects from other applications (e.g., MathType, PowerPoint, etc.) and paste the object into an EES plot window. The object can then be moved or resized in the usual manner.

Version 6.142 01/20/01
DATE$ and TIME$ string functions have been added to return the current date and time, respectively.

Version 6.135 01/15/01
A command to generate a high quality report in LaTeX and PDF (portable document interface) has been implemented in the file menu. To create and view PDF files, it is necessary to install a LaTeX compiler and Adobe Acrobat. Both of these applications are available at no cost. Instructions for downloading these applications and using the Create LaTeX/PDF Report command are provided in the online help.

Property data for ideal gas C2H4 (ethylene) have been implemented.

Version 6.130 01/08/01
Thermodynamic functions CP and CV have been added to calculate the specific heats at constant pressure and volume, respectively. CP provides exactly the same result as the SPECHEAT function. The

ISENTROPICINDEX function which in previous versions provided the ratio CP/CV has been replaced with the related SOUNDSPEED function which returns the speed of sound through the fluid in [m/s] or [ft/s].

Subprograms are now supported. Subprograms are very similar to Modules, the difference being in how the calculations are actually done, as explained in the online help.

Version 6.125 12/25/00
Grouping of drawing object and text that it not used for input/output is now supported in the Diagram windows. Use the group/ungroup buttons on the tool bar or right-click on a selection to access the grouping capabilites.

Version 6.115 12/14/00
High accuracy property data for Hydrogen have been added.

Version 6.110 12 0
The drawing environment on the Diagram and child Diagram windows have been improved. It is now possible to copy graphic objects from and to external programs, such as PowerPoint and CorelDraw. Multiple graphic objects may be placed on the Diagram window, moved, and resized.

Version 6.105 12/02/00
The Copy Plot command has the capability of placing two copies of the plot on the clipboard. One copy is a Picture (enhanced metafile) and the other is a high precision bitmap. The high precision bitmap provides a high quality plot image, but it consumes a great deal of memory - particularly so if the image is in color. Starting with Version 6.105, the option of placing a bitmap copy on the clipboard is, by default, disabled. Instead, the picture is copied as an enhanced metafile with a default resolution of 600 pixels per inch so it will print at high quality from the application it is pasted into. The resolution of the clipboard copy, and options for copying in color and as a bitmap can be changed in the Plots Tab of the Preferences dialog.

Version 6.088 11/07/00
Buttons have been provided on the Diagram Window Text Input Dialog to facilitate entry of subscripts, superscripts and symbols.

Version 6.087 11/06/00
If the Solution Window was visible when the file was saved, it will be visible when the file is opened.

Version 6.076 10/22/00
Multiple copies of EES will each have a unique name, e.g., EES(2), EES(3), etc. An option is provided to eliminate the warning that appears when EES is started while other EES applications are running.

Version 6.075 10/21/00
High accuracy property data for n-pentane have been implemented. n-Butane and R600 now both use the high accuracy property data for n-butane.

Version 6.074 10/20/00
A WARNING procedure has been implemented (similar to the ERROR procedure) to allow the user to display warning messages. Previously, only the last warning message could be displayed. However, now warning messages are placed in a message que and all of the messages are displayed when calculations are completed. The warning messages are not generated or displayed unless the 'Show Warning Messages' checkbox in the Options tab of the Preferences dialog is checked.

Version 6.066 10/10/00
The Solution window provides separated tabbed windows to display values of local variables in functions, procedures, and modules. This capability is controlled by the 'Show function/procedure/module values' control in the Options tab of the Preferences dialog.

The $Import and $Export directives will accept Clipboard in place of a filename.

Version 6.061 10/03/00
Print Preview now offers Zoom In/Out capability.

Version 6.056 9/24/00
Comments can now be displayed in underline font. The setting is provided for both screen and printed display in the Preferences dialog.

Version 6.055 9/22/00
It is now possible to send any macro command directly to EES from another application such as EXCEL. See the online help section for Dynamic Data Exchange (DDE)

Version 6.044 9/4/00
The StringLen returns the number of characters in the string constant or string variable supplied as an argument. For example, StringLen(A$) returns the length of the string stored in variable A$.

The NLookupRows function returns the number of rows in the Lookup table or Lookup file specified in the string argument. For example NLookupRows('Lookup 1') returns the number of rows in the Lookup file named 'Lookup 1'.

A help context file can be provided with library help files. The help context file has the same name as the library file but with a .CTX filename extension. EES will look for the .CTX file when help is requested. If a .CTX file is found, EES will open the file to find the context number for the topic that has the name of the function for which help is requested. The Help file will be then opened directly to that topic. See help on Library Files for details.

Version 6.042 8/31/00
The $SaveLookup directive will accept a ? or ?? for the filename that the data are to be saved to. In this case, a standard save file dialog will appear from which the filename can be chosen. For example:
$SaveLookup TN$?
will save the Lookuptable having a name that is stored in string variable TN$ to a file selected from the save file dialog and the selected file will replace the ? so that the save dialog does not reappear. If ?? is used, the replacement will not occur.

Version 6.041 8/30/00
The $OpenLookup directive can have an optional second parameter which must be a string variable name. The name of the Lookup file that is opened is assigned to this variable. For example:
$OpenLookup ?? myLookupFile$
will bring up a standard file input dialog from which the file name can be selected. That Lookup file will be opened and copied into the Lookup Table Window and myLookupFile$ will be set to the name of the file.

Version 6.040 8/28/00
Plots now over the option of a 2nd X axis (X2) scale. The axis scale is initially placed at the top of the plot but it can be moved with the Ctrl up/down arrow keys. The 2nd Y axis (Y2) scale can be moved with the Ctrl left/right arrow keys. The Modify Plot dialog now provides additional controls to allow the axis scale to be changed after a plot is constructed.

Version 6.035 8/18/00
Thermodynamic property data for methanol have been implemented.

Version 6.032 8/13/00
Controls are now provided in the Modify Plot dialog to separately display error bars in the X and Y directions.

Version 6.030 8/09/00
Property data for R507A are now built into EES. The transport properties for R404A, R407C, R410A, and R507A have been update using recent correlations presented by Geller et al. See the online help for the respective fluids for details.

Version 6.029 08/07/00
The width and height of buttons in the Diagram window can be adjusted in Development mode by selecting the button and holding the Ctrl key depressed while pressing any of the arrow keys. For example, Ctrl-right arrow increases the width of the selected button by 1 pixed. Ctrl-Left arrow decreases the width. If the Ctrl key is not pressed, the button position, rather than its size, will be changed.

Version 6.022 07/27/00
A menu item has been added in the Help menu to access the EES manual in Acrobat format. The menu item will be disabled if file EES_Manual.PDF is not in the directory that EES is started from or if Acrobat is not installed.

A $Import directive has been implemented to directly read variable values from a text file. The $Import directive has the following format:

$Import 'FileName.csv' A, B, C, X[1..5], G$

Note that both string and numerical values can be read from the disk file. See the online help for details.

A ? or ?? can be supplied as the filename in the $OpenLookup directive (Professional version). When the $OpenLookup directive is processed,, a Windows open file dialog will appear from which the filename can be chosen. If a single ? is supplied, it will be replaced with the selected filename. The double ? will not be replaced so that the open file dialog will appear everytime the $OpenLookup directive is processed.

Version 6.020 07/20/00
An expiration date can now be optionally specified for Distributable programs generated with the Make Distributable command (Professional version).

Version 6.008 07/12/00
The $OpenLookup directive will accept either a string constant or string variable for the Lookup file that is to be opened.

Version 6.007 07/11/00
The $SaveLookup directive will now accept string variables for both the Lookup tablename and the filename, e.g., $SaveLookup TableName$ FileName$ where TableName$ and FileName$ are set somewhere during the solving of the EES equations.

Version 6.005 07/10/00
It is now possible to place EES variable information (name, current value, and units) in a text item that appears in a Plot Window. Clicking the text button the Plot Window toolbar will initiate a dialog in which a normal text item or EES variable information can be displayed.

Version 6.001 07/04/00
Right-clicking on a tab in the Parametric, Lookup, or Plot windows initiates a dialog in which the tab name and position can be changed. A delete button is also provided to delete the window.
Macro commands now recognize Paste Parametric and Paste Lookup commands.

>Version 6.000 07/01/00
Version 6.0 incorporates the following major improvements in the EES user interface.
1. There is no limit on the number of Parametric and Lookup tables. Earlier versions allowed only 1 table of each type.
2. There is no limit on the number of Plot windows. (Earlier versions allowed 10.)
3. Tabs are provided on the Parametric, Lookup, and Plot windows for easy access. The tab names can be changed by right-clicking on the tab.
4. Capability to insert and delete rows and columns in any table is now provided by right-clicking on the column header
5. The width of one or more columns in a table can be changed by selecting the column(s) by clicking in the header cell (top row) followed by right-clicking. A pop-up menu will appear with Properties as one of the options.
6. A range of variable names can be selected when creating a new Parametric table or when adding variables to the table by pressing the Shift key.
7. Additional buttons have been added to the speed bar for access to the Lookup, Arrays, Integral, and Plot Windows.
8. The .WMF files previously used to store pictures in the Professional version are no longer needed.

>Version 5.216 05/24/00
Undo has been implemented for the Plot Windows.

>Version 5.208 05/14/00
The Property Plot now provides an option to present a psychrometric chart in the Mollier format which is commonly employed in European countries.

>Version 5.201 04/30/00
Selected rows or columns in the Parametric and Lookup tables can be deleted by pressing the Delete key or by applying the Delete command in the Edit menu. The Undo command in the Edit menu now functions for operations on the Parametric and Lookup tables.

>Version 5.199 04/29/00
Property data for RC318 (octafluorocyclobutane) have been implemented. Viscosity data are now available for iso
ing theVersion 5.195 04/24/00
The Tab key can now be used to move from one input to the next on the Digram Window. The tab order can be set by right-clicking on the text while in the development mode (toolbar visible).

>Version 5.191 04/15/00
Thick dotted and dashed lines on plots is now an option. Plots having dotted lines will now display properly when copied as a bitmap to another application, such as Word.

>Version 5.186 04/09/00
An autosave option has been added to automatically save your work to a temporary EES file. The temporary EES file has the same name as the file that you are working on but the filename is prepended with a tilde (~). By default, EES will automatically save the temporary file every 10 minutes. You will be prompted to enter a filename for a new file if you have not saved it at least once before the autosave attempt. EES will automatically delete the autosave temporary file when a new file is created or opened or when EES is closed. However, if EES quits unexpectedly, the last autosave file should be available to recover your work. The autosave options are controlled by settings in the Options tab of the Preferences dialog (Options menu).

>Version 5.182 04/05/00
Automatic rescaling of plot axes is now an option that is controlled for each axis with the 'Automatic scaling' checkbox in the Modify Axis dialog window. When this option is selected, EES will automatically select appropriate axis scaling to accomodate the data in all plots for the plot window.

>Version 5.180 04/01/00
High accuracy property data are now available for isopentane, ethylene, and propylene.

>Version 5.178 03/29/00
Function VOLEXPCOEF returns the volumetric coefficient of thermal expansion for the specified fluid and conditions.

>Version 5.175 03/26/00
When an assignment of the form Q=20*convert(Btu/hr,kW) is used, EES will assign units of kW to Q. EES will also propagate units on simple assignment statements, so that if a statement of the form T2=T1 is solved and T1 has units, T2 will be assigned to the same units.

>Version 5.170 03/19/00
When a variable is set using one of the built-in property functions, its units are now automatically assigned.

>Version 5.157 02/25/00
High accuracy property data are now available for R-23.

>Version 5.151 02/09/00
Background colors can now be assigned to text placed on the Diagram window.

>Version 5.148 02/03/00
The caption for each of the 10 plot windows can now be changed in the Modify Plot dialog window.

>Version 5.146 01/30/00

The automatic step size adjustment algorithm used in equation-based Integrals has been improved. The parameters which control the calculation effort and accuracy of integration are entered in the Tolerances dialog (Options menu) which replaces the former Stop Criteria dialog.

>Version 5.140 01/18/00
An $EXPORT directive has been provided to allow selected variables to be written to an ASCII file in .TXT or .CSV formats. This directive simplifies the task of copying results to an EES Lookup file or to another application.

> Version 5.139 01/17/00
EES now can read and write data with the .CSV file format. The format provides a convenient method to export data from a Lookup table to another application.

> Version 5.136 01/12/00
Transport properties are now provided for lithium bromide-water mixtures with functions VISC_LIBR and COND_LIBR. Details are available by clicking the Function Info button in the Function Info dialog window after selecting External routines and selecting one of these functions.

> Version 5.133 01/09/00
High accuracy property data for Argon is now provided.

> Version 5.130 01/07/00
EES is now Windows 2000 compatible.

> Version 5.125 12/25/99
Properties for refrigerant R152a have been added to the data base.

The correlation for liquid transport properties presented by M.J. Assael et al., "Viscosity and Thermal Conductivity of Halogenated Methane and Ethane Refrigerants", IJR 22, pp. 525-535, 1999, has been implemented for R152a, R134a_ha, R22_ha, and R32.

> Version 5.122 12/18/99
Right clicking in the Row column of any table now brings up a menu that allows a back color or border to be associated with the row.

> Version 5.115 12/05/99
Simple algebraic expression involving previously set constants and parentheses can now be used to specify limits for the SUM, PRODUCT functions and the DUPLICATE statement.

>Version 5.113 12/03/99
High accuracy properties are now available for R22 in fluid R22_ha.

> Version 5.110 11/28/99
It is now possible to save a diagram input (.VAR) file with a specified file name using the Save button on the Diagram window. The toolbar allows a Load button to be placed on the main Diagram window. Clicking the Load button will open a specifed .VAR file and update all of the inputs fields in the Diagram windows.

A Print button can be placed on Diagram windows with the Show/Hide Print button on the toolbar. Clicking the Print button will print the contents of the window to the default printer.

> Version 5.109 11/26/99
The 255 character limit for the maximum length of the lines EES processes has been removed for comments. It is now possible to enter long paragraphs of comments. The comments will automatically line break to fill the Equations window if the Wrap Long Lines option in the Preferences Equations tab is selected. The Formatted Equations window will also line break the comments in the display window and in the printed output.

> Version 5.106 11/22/99
String variables can now be used to specify the units of other variables. For example:

```
U$='kJ/kg'
h=15 "[U$]"
```

The comment to the right of the 15 sets the units of variable h to U$. The units could also be set in the Variable Info dialog or by clicking on h in the Solution window. In any case, EES will recognize that U$ is a string variable and set the units of h to the string that is assigned to U$.

> Version 5.101 11/14/99
Commands to control Microsoft WORD have been added to the Macro command list. It is now possible to open a WORD document, paste the solution window, tables, and plots, save the WORD document and close WORD, all with Macro commands in EES.

> Version 5.094 11/04/99
It is possible to use a drop-down list in a Diagram Window to set the values of one or more EES variables. This is accomplished by following the string that is to be displayed with characters // and then with one or more EES equations on one line. For example, the string

```
Copper // density=8933; conductivity=400
```

will display Copper in the drop-down list, but EES will execute the statements to the right of the // characters when the a choice is made from the drop-down list or when calculations are initiated. If the string is

```
User Input // density=?; conductivity=?
```

EES will look for Diagram Window Output specifications for Density and Conducitivity, and if found, they will be changed to Input variables. This capablity provides a method of exchanging Input and Output variables on the Diagram window. See the on-line help for the Diagram Window for more information. Also, look at new example Diagram_IN_OUT.

> Version 5.090 10/31/99
A new property function called SURFACETENSION provides surface tension data for real fluids.

> Version 5.088 10/28/99
High accuracy thermodynamic properties of water are now provided in substance Steam_IAPWS which implements the 1995 Formulation for the Thermodynamic Properties of Ordinary Water Substance for General and Scientific Use, issued by The International Association for the Properties of Water and Steam (IAPWS). This capability is available only in the Professional version.

> Version 5.083 10/18/99
The Lookup$Row function has been implemented. See the online help for details.

> Version 5.079 10/14/99
Appending _hat to a variable name, e.g., F_hat, places a ^ symbol above the name.

RANDOM(A,B) returns a uniformly distributed number in the range between A and B. This function can be used only within EES Functions and Procedures.

> Version 5.067 10/3/99
The contour plot algorithms now allow the plot resolution to be specified. The calculation speed has been increased by an order of magnitude

> Version 5.061 9/28/99
Clicking the left mouse button in the leftmost column of a row in any table will select all of the cells in that row. If the mouse button is held down while the mouse is moved to other rows, these rows will be added to the selection. Rows can also added by holding the Shift key down while clicking in the leftmost column. All of the cells in a column can be selected in a similar manner by clicking the left mouse button in the column header. Note that it is now necessary to right-click in the cell header to bring up the dialog that allows the format, units, and other information in a column to be edited. Right-clicking after selecting a range of cells brings up a popup menu that allows selected printing, copying, and other options.

> Version 5.059 9/26/99
A plot window that is displayed using a plot window button on a Diagram window now has a small button at the bottom right which returns the focus to the Diagram window that contains the plot window button.

The IsentropicIndex function has been added to the list of built-in property functions.

> Version 5.058 9/24/99
The IsIdealGas property function has been added. The use of this function is explained in the online help.

> Version 5.055 9/21/99
The bitmap resolution and black&white/color setting of plots copied to the clipboard can now be set in the Preferences dialog/Plot tab. Use the Paste Special command in an external application such as a word processor, to select the type of paste operation. Pasting a plot as a Device Independent Bitmap provides the highest quality image but it requires the most memory. Pasting as a picture requires the least memory.

> Version 5.053 9/18/99
Calculate buttons can now be placed on child Diagram windows. Link and Plot window buttons can display a bitmap.

> Version 5.048 9/12/99
EES will replace _star with a superscript * in the Solution and Formatted Equations windows. For example, T_star will display as T*.

> Version 5.047 9/9/99
The Units.Txt file has been modified to accept μm as a length unit. To enter μm, hold the Alt-Key down and type 230 on the numeric keypad. Let the Alt key up and the μ should appear. Then enter m. Other useful characters are Alt-248 which displays the degree symbol ° and Alt-250 which appears as a dot (·) and is used to represent multiplication. The Convert routine in EES will accept a hypen (-), a star (*) or character 250 (·) as a separator for units. For example, W-hr, W*hr and W·hr will all be accepted in the Convert command for Watt-hours.

> Version 5.044 9/5/99
You may not have known that there was a 64 kByte limit to the amount of text that could be entered into the Equations window. That limit has been raised to 128 kBytes.

> Version 5.042 9/3/99
A larger range of colors for objects (boxes, circles, and lines) on the Plot and Diagram windows is now available.

> Version 5.040 8/31/99 (Professional version)
The Make Distributable dialog window now has buttons to save and load scripting information. The save button copies all information in the Make Distributable dialog window to a file having a .MDI filename extension. The load button allows a .MDI file to be opened so that the information in the file can be used to fill the fields in the Make Distributable dialog window.

> Version 5.038 8/28/99
The transport property correlations of Vesovic et al. have been implemented for fluid CarbonDioxide_ha.

> Version 5.034 8/24/99
EES will now accept HTML files (*.htm) help files in addition to ASCII text (*.txt) and Windows help (*.hlp) files. Any of the three file types can be used to provide user help for library files, EES files loaded from the Textbook menu, and files created with the Make Distributable command. Help buttons placed on the diagram window and child diagram windows can also now use any of the three help file formats.

> Version 5.032 8/22/99
Child diagram windows can now have their own child windows (Professional version).

> Version 5.028 8/17/99

Right-clicking on Parameteric, Lookup, Arrays, or Integral table will bring up a pop-up menu allowing the currrent selection to be cut, copied, or printed. This option provides a convenient way to print a specified section of a table.

> Version 5.026 8/15/99
Holding the Shift key down while creating or resizing lines/arrows on the Plot and Diagram windows will constrain the lines to be horizontal, vertical, or on a 45 degree angle. If the Shift key is depressed while creating or resizing rectangles or circles, the rectangle or circle will be drawn with equal height and width.

The PRANDTL function has been added.

Right-clicking the mouse on the Equations window now brings up a pop-up menu allowing the current selection to by commented, cut or copied. Access to the Variable Info dialog window is also provided.

>Version 5.020 7/31/99
Temperature - enthalpy plots can be generated using the Property Plot option in the Plot menu for substances using the high accuracy Fundamental Equation of State. The on-line help for Fluid Property Information identifies the substances that use this equation of state.

> Version 5.016 7/27/99
A temperature conversion function has been implemented. The ConvertTemp function has the following format: ConvertTemp('C', 'F', T). The first two parameters are string constants or string variables which must be C, K, F, or R, respresenting the Celsius, Kelvin, Fahrenheit, or Rankine scales. The third parameter is a temperature in the scale indicated by the first parameter. The function returns the temperature in the scale indicated by the second parameter. In the example above the function would return the temperature in F corresponding to the temperature T in C. The single quotes around the string constants are not required.

> Version 5.015 7/26/99
An IntegralValue function has been implemented to allow retrieval of data from the Integral Table. (See version 5.004)

> Version 5.014 7/22/99
The arrowhead size can now be changed on the Plot and Diagram windows. The arrowhead size is automatically scaled when the Plot or Diagram size is changed.

Ø Version 5.012 7/19/99
Ø A Data button has been added to the Modify Plot dialog. This button becomes active if the Automatic Update option is enabled. When clicked, the Data button allows the source of the plotted data to be changed. It is possible to change the range of rows, the X and/or Y- axis columns and the table from which data are plotted. EES will automatically update the plot to reflect the change in the data source. The most common use for this capability is to change the range of rows that has been previously selected for a plot line.
Ø
High accuracy properties for Helium have been incorporated.

> Version 5.005 7/12/99
Link buttons can now be placed on the Diagram window in the Professional version. Clicking a link button can be used to start an external application or run a specified EES program. This capability simplifies chaining EES programs for sequential operation. High accuracy property data for nitrogen have added replacing the previous less- accurate correlations. The new property data are valid from 65 to 2000 K at pressures up to 1000 MPa.

> Version 5.004 7/03/99
A new directive called $IntegralTable allows intermediate values of specified variables during numerical integration with equation-based Integral functions to be automatically placed in an Integral Table. The values in the Integral Table can be plotted, printed, or copied. See the on-line help for details.

> Version 4.993 6/12/99
High accuracy thermodynamic and transport properties for propane and isobutane have been added.

The Professional version provides a means of creating a distributable program that can include up to five EES programs. Normally, the first EES program is the one that shows up when the distributable program is launched. However, placing a /# (where # is an integer between 1 and 5) as a parameter will select that file at startup. For example, entering MyDist.exe /2 into the Windows Run dialog window will start the distributable program called MyDist.exe and bring up the second file.

Text and objects on the Diagram windows can now be selected using a selection rectangle, as in most drawing programs.

> Version 4.989 6/9/99
A help button can be placed on the Diagram window and on Child Diagram windows. Clicking the Help button opens a specified help ASCII text or Windows .HLP file. The Windows menu Diagram window item will now list child Diagram windows (Professional version).

> Version 4.987 6/7/99
The Viscosity and Conductivity functions now allow any set of independent properties as inputs. The Convert function will now accept a star (*) as well as a dash (-) as a separator between units.

> Version 4.985 5/28/99
A function called NTABLEROWS has been added. This function takes one string argument and that argument may be 'Parametric', 'Lookup', or 'Arrays' or the name of a Lookup file stored on disk. In this case, the name may be provided as a string constant or a string variable. The function returns the number of rows in the specified table.

> Version 4.980 5/20/99
Two new directives have been added to the Professional version. $OPENLOOKUP LookupfileName will open the a Lookup Table and read the data in the file designated as LookupFileName. SAVELOOKUP LookupfileName will save the Lookup Table in a file with the specified name.

A SAVE button can now be placed on the Diagram window of Distributable programs (Professional version). When clicked, the SAVE button saves the current values of all variables and the current values for all input variables in the Diagram window in a .VAR file having the same name as the parent EES file. This file is automatically loaded with the distributable program is opened which restores the inputs in the Diagram window to the values they had when the SAVE button was clicked.

> Version 4.970 5/1/99 - 612/99
High accuracy property data are now available for a number of fluids including carbon dixiode, methane, ethane, propane, isobutane, n-butane, R32 ammonia, oxygen and R134a. The on- line help has been modified to provide the source of the data and its limits of applicability. The Property Plot dialog (Options menu) has been expanded to allow additional information to be placed on the property plots.

> Version 4.960 4/14/99
Palettes for lower and upper Greek letters and special symbols have been added to the Format Text dialog to simplify input of text that is to be placed on a Plot window. The Format Text dialog appears by right-clicking or doubling clicking on a text item in the Plot window.

> Version 4.949 3/26/99
(Professional version) If the cursor is positioned over an input or output variable in the Diagram window or child Diagram window, the name of that variable will be displayed as a hint if the tool bar is visible.

> Version 4.946 3/24/99
To maintain consistency with other Windows software, it is now necessary to hold the Shift key down when selecting multiple items in the Plot and Diagram Windows. Up to this version, pressing the Shift key displayed crosshairs on the Plot windows. Now this capability is enabled with the Ctrl key.

> Version 4.943 3/22/99
The Print command dialog has been modified to allow selected printing of child Diagram windows (Professional version).

> Version 4.942 3/19/99

The Find command can now be used in the Residuals window.

> Version 4.935 03/11/99
The Professional version now allows up to 10,000 variables and equations.

> Version 4.917 02/15/99
The Residuals window now uses bold font to show which variables are determined by the equation(s) in each block. This capability makes it easier to see the order in which EES is determining the values of the unknown variables.

> Version 4.911 02/08/99 and 4/07/99
The units of a variable which is on the left side of an equation (by itself) in the Equations window can now be automatically set using a comment in which the units are enclosed in braces. Additional text following the unit specification can be provided. For example:

```
h=400 "[Btu]"
P4=P3/100 "[bar]   this equation will set the units of variable P4 to bar"
```

> Version 4.908 02/03/99
A Check Units command has been added to the Calculate menu. This command will check the dimensional and unit conversion consistency of all equations except those in functions and procedures. It is necessary to enter the units of each variable for the checking process to function properly. The units can be entered in the Variable Info dialog window or in the Solution window. The checking algorithm cannot know the units of conversion constants, so it is best to avoid them in your equations. The Convert function should be used instead. For example, suppose you have two variables, L_inch and L_feet, whose units are set to inches and feet, respectively. This following equation will not check properly because the units of 12 are not known.

```
L_inch=L_feet*12
```

However, if the convert function is employed as shown next, the equation will be accepted.

```
L_inch=L_feet*convert(ft,in)
```

> Version 4.906 01/31/99
A set of string functions has been implemented to facilitate manipulations of string variables. The string variables are: CONCAT$, COPY$, LOWERCASE$, STRING$, STRINGPOS, STRINGVAL, and UPPERCASE$. Detailed information is available in the on-line help.

> Version 4.896 01/11/99
The size of the symbol used in plots can now be modified in the Modify Plot dialog. The symbol size scales proportionally as the plot rectangle is resized. In plots with many points, placing a symbol at each point results in a messy plot, although some symbols may be needed for plot line identification. The Modify Plot dialog now also provides a control to specify symbols to be drawn every N points, where 1<N<# of points. The Modify Plot dialog is accessed with the plot menu or by right-clicking on the plot window.

> Version 4.890 01/04/99
A plot window access button has been added to the Diagram window toolbar. When clicked, the plot window access button displays a small dialog in which the desired plot window and button caption can be entered. A button with this caption then appears on the Diagram window and it can be dragged to the desired location if the tool bar is visible. Clicking this button when the tool bar is hidden will display the Plot window.

> Version 4.884 12/15/98
The operation of the Diagram window has been changed. First, a tool bar has been added to this window and to the child Diagram windows (Professional version) to create graphic objects (text, lines/arrows, rectangles, and ellipses) and to manipulate these objects. Second, the Diagram window now has two modes: development and application mode. The development mode is active when the tool bar is visible. Objects in the Diagram window can be moved, modified, or deleted in development mode. The entire window can be resized. However, the input variable edit boxes and drop-down lists are disabled in development mode. When the tool bar is hidden, the Diagram window is in application mode. In application mode, the graphic objects cannot be moved or modified. The Diagram window will accept user input and, after calculations are completed, the values of output variables will be displayed. Ctrl-D is a keyboard shortcut for the Diagram window. If the Diagram window is not in front, Ctrl-D brings it to the front. If the

Diagram window is foremost, Ctrl-D toggles the visibility of the tool bar. Shift-Ctrl-D toggles the visibility of the tool bar in the Diagram window and all child diagram windows.

> Version 4.882 12/10/98
A tool bar has been added to the plot windows to facilitate adding text, lines/arrows, boxes and ellipses. A Show/Hide tool bar command in the Plot menu replaces the Add Text and Add Line commands. Multiple items on the plot window can now be copied, moved, and alligned.

> Version 4.876 11/30/98
Plots printed by EES on a laser printer look great. However, when the plot is copied and pasted to another application, such as a word processor, the quality of the printed plot is not as good. The reason for this degradation in quality is that the plot is copied at the resolution of the screen. However, in this version, the Copy Plot command now also puts a high resolution bitmap on the clipboard. You can select a picture (as before) or a bitmap using the Paste Special command in the external program. The bitmap requires much more memory, but it produces a high quality image when printed.

> Version 4.874 11/27/98
Selected text items in the Diagram window can now be cut, copied, and/or pasted to a child diagram window or to a Diagram window in a different EES program (Professional version only). To select one or more text items in the Diagram window, hold the Shift key down while clicking on the text item. To select a drop-down string list, click just the left of the rectangle. Selected text items are displayed within a red dotted rectangle. To unselect text items, click anywhere on the Diagram window, but not on a text item.

> Version 4.873 11/25/98
The Plot Windows 'fly-out' menu that appears when the Plot Windows menu item is selected from the Windows menu now displays each plot window as the mouse is moved over the different plot window menu items. This behavior should make it easier to find the plot window that you wish to move to the front. You can disable this behavior by holding the Ctrl key down while selecting the plot window menu item.

> Version 4.871 11/23/98
Variable Information files with filename extension *.VAR can now be opened with the $INCLUDE directive.

> Version 4.867 11/16/98
Two small buttons have been added to the Variable Info dialog (Professional Version only) to allow variable information to be read from or saved to a file. The variable information file has a .VAR filename extension, but it is a text file that can be opened in a word processor or spreadsheet. Variable information data can be saved to an existing .VAR file. In this case, the file is updated with the current information for the variables that are in use. Information in the file concerning variables that are not currently in use is not modified or deleted. If a program contains one or more modules, a dropdown list appears at the top center of the Variable Info dialog from which the module or main program can be selected. Variable information are read or saved for the selected module or main program. The read and save variable information buttons make it very easy to prepare and use a file containing your common variables with appropriate guess values, limits, and units.

> Version 4.863 11/11/98
The Lookup table will now accept string data, as well as numerical data. The format style must be set to String. This change is made by clicking in the column header and selecting String as the style. The LOOKUP$ function is used to return string data. It operates exactly like the LOOKUP function.

> Version 4.859 11/05/98
A Directories Tab has been added to the Preferences dialog in the Options menu. Default directories for opening and saving files can now be specified. In addition, a directory in addition to the USERLIB directory can now be used to preload library files when EES is started. See the on-line help for details.

> Version 4.853 10/27/98
An EES variable with name JTHETA will be displayed as a J in Symbol font, which appears as a 'curly theta'.

> Version 4.852 10/26/98

The maximum number of rows in the Parametric and Lookup tables has been increased to 9000 from the former limit of 6500. There is no limit to the number of rows in the Professional version.

> Version 4.851 10/25/98
A green 'go' triangle is displayed in the upper left cell of the Parametric table. Clicking the left mouse button in this triangular area will initiate the Parametric Table calculations for the rows indicated below the triangle. The row range is that selected during the last use of the Solve Table dialog. To select a different range, click the left mouse button in the first row. Hold the Shift key down and then click the mouse in the last row. Continue to hold the Shift key down while clicking in the green triangle.

A shorthand notation for array variables has been implemented to facilitate passing of array variables to internal and external Functions and Procedures. A range of array variables can be indicated by separating the first array index value from the last index value by two decimal points. For example, X[1..5] can be used in place of X[1], X[2], X[3], X[4], X[5]. This shorthand notation is supported for two dimensional array variables as well. Since all EES statements must be 255 or fewer characters, this notation can be used to pass long argument lists. The notation can be used in the arguments of function calls and CALL statements, in Function and Procedure statements and in $Common directives. See Array Range Notation in the online help for details.

The AVERAGE function has been added as a built-in function. The SUM function has been modified to accept a list of argument, in addition to the former index-based format.

There is no longer any inherent limit on the number of variables that can be passed to an external procedure with .FDL format. (The former limit was 50 inputs and 50 outputs). Up to 1000 variables can be passed in the argument list of external functions using array range notation.

> Version 4.850 10/22/98
EES now will display unmatched left or right parentheses in bold during input in the Equations Window.

> Version 4.847 10/17/98
A Calculate button can be placed on the Diagram Window. Right clicking on the Calculate button allows both the button caption and the action taken when the button is clicked to be modified.

> Version 4.821 9/04/98
Support is now provided for mouse wheel scrolling.

> Version 4.818 9/01/98
The professional version of EES will now allow macro files to be played from another application using dynamic data exchange control. The online help provides the details.

> Version 4.812 8/22/98
EES now provides bar plots and contour plots in addition to the X-Y plots provided in previous versions. The New Plot Window command displays a submenu with the three plot types. Look at the online-help for X-Y plot, bar plot and contour plot for details.

EES recognizes three externally compiled files of types .DLF, .DLP, and .FDL. Previously, only one routine could reside in an externally compiled file. It is now possible to include one or more external routines in a .DLL file. All three file types can be included in the same file. The mechanism for telling EES the names and types of the external routines is to provide three short routines in the DLL file with names DLFNames, DLPNames, and FDLNames that do nothing but return the calling names of each routine type in the DLL file. DLFName, DLPNames, and FDLNames must be exported in the DLL. They have one argument which is a character string. The character string is filled with the names of the routines of each type that are contained in the DLL file. A comma separates each file name. A zero length string is used to indicate that there are no files of that type. An example, written in DELPHI 4 is provided in the on-line help.

> Version 4.810 8/20/98
Right-clicking on the Calculate button in the Diagram window will allow the Calculate button caption to be changed.

A French version of EES has been developed. Contact F-Chart Software if this is of interest to you.

> Version 4.802 8/10/98
The New Plot and Overlay Plot commands have been modified to allow multiple variables to be selected in the Y-axis list. A separate plot line will be generated for each selected variable. All selected variables will be plotted with the same axis scale. If more than one Y-axis variable is selected, the symbol and color list boxes will display 'auto'. With the 'auto' option, the symbol and color for each plot line will be automatically selected by EES so that each plot line has a different symbol and color. This feature can be overridden by simply selecting the symbol and color.

> Version 4.791 7/25/98
Subscripts and superscripts are now displayed in comments in the Formatted Equations window.

>Version 4.790 7/20/98
The capabilities of the Debug window have been expanded. If EES detects that a solution is constained, the DEBUG window will display all variables and equations that are are constrained. Clicking on a variable will open the Variable Info dialog where the lower or upper bound on the variable value can be changed.

> Version 4.784 7/6/98
The Variable Info dialog now provides a Show Array Elements checkbox control when one or more arrays are present in the Equations window. When this control is selected, all array elements appear in the Variable Info dialog and the guess value, bounds, display format, and units can be set for each individual element as before. However, when the control is not selected, all arrays elements are represented by a single entry. For example, X[ ] represents all array elements with parent name X. If any of the characteristics for the array are changed, that change is applied to ALL array elements. For example, changing the guess value for X[ ] will result in the new guess value being applied to all array elements in array X. However, other characteristics, such as the bounds and units, would not be affected. In addition, the array name can be changed by editing the name in the first column of the Variable Info dialog. (Note that the names of array elements, e.g., X[5], can not be edited.) If an array name is changed, that change is applied to all array elements. The change occurs in the Equations window, the tables, and the Diagram window.

> Version 4.782 7/1/98
A Calculate button can now be placed on the Diagram window to more conveniently initiate calculations involving input and output variables in the Diagram window. The button is enabled with a check box control in the Add Diagram Text dialog which appears whenever Diagram window text is added or modified.

> Version 4.781 6/26/98
Undo is now accessible for the Solution window.

> Version 4.776 6/15/98
Store and Retrieve Parametric Table commands have been added to the Tables menu. The Store Parametric Table command will save all information relating to the existing Parametric table in a binary file having a .PAR filename extension. The Retrieve Parametric table will read a specified .PAR file and restore the Parametric table to the same condition it was in when the Store Parametric Table command was issued. Although EES only allows one Parametric table at a time, the Store and Retrieve Parametric Table commands provide almost the same effect as having multiple Parametric Table windows.

> Version 4.775 6/10/98
This version heralds the introduction of the Professional version of EES. The Professional version provides the following capabilities:
1. A series of EES instructions (called a macro) can be recorded with the Build Macro command in the File menu. EES can later be started from the Windows Run command or from a different program to replay all of the instructions in the Macro file. Used in this manner, EES can be directed to solve a set of equations in a specified text or EES file and put the solution into another specified text file without ever appearing on the screen. The online help for the Build Macro command provides details.

2. The capabilities of the Diagram Window have been expanded. It is now possible to define 'hot areas' in the Diagram Window which, when clicked, bring up a child Diagram window having all of the same

capabilities as the main Diagram Window. A link to 'hot areas' and 'child Diagram windows' can be found in the online help for the Diagram window.

3. The Make Distributable Program was available in previous versions. However, this capability is now available only in the Professional version.
}
{! Contact F-Chart Software if you wish to update your existing version of EES to a Professional version.
}
{
> Version 4.770 6/08/98
Entering the values of array variables can be painful in EES. For example, if you want to define array X with 10 values ranging from 1 to 10, you would have to enter X[1]=1; X[2]=2; etc. The new Insert/Modify Array command in the Edit menu has been implemented to help enter values for one and two-dimensional arrays. After selecting this command, you can enter (or paste) the values directly into a spreadsheet-like table. When you click the OK command, EES will generate the necessary EES equations to define the array at the bottom of your Equations window. EES will surround the array equations with a special set of comments. If you later modify the array, EES will look for these comments to determine if the array has already been set. Set the on-line help for details.

> Version 4.750 5/02/98
Multiple text items can be selected in the Diagram Window by holding the Shift key down while clicking on the text item. A red dotted box will be displayed around each selected text item. Pressing the right mouse button (or selecting the Modify Diagram Text command in the Options menu) will bring up a dialog window in which the characteristics (font, color, size, etc.) of all selected text items can be changed at once. Also, the dialog window allows the selected text items to be aligned with respect to each other. All selected text items move in response to the arrow keys.

> Version 4.750 5/02/98
EES can now display superscipts in variable names in the Formatted Equations and Solution windows. The vertical bar character (|) signified the start of a superscript. For example, G|o will display as G with a superscript o.

}
{!>Version 4.750 5/02/98
Did you notice that this comment is a different color? The exclamation character as the first character of the comment causes this to happen. You can now set the colors and styles of the comments, and other information, in the Preferences dialog. The Print in Color control has been moved to the Print dialog where it is more visible and easier to access.}

{> Version 4.741 4/13/98
The printer can now be selected directly from the Print dialog.

> Version 4.735 4/5/98
The Screen tab of the Preferences dialog now allows comments in the Equations and Formatted Equations window to be displayed in italics or bold.

> Version 4.733 4/1/98
Refrigerant names R717, R718, and R744 are now recognized.

> Version 4.726 3/21/98
A number of conveniences have been added to the Plot Windows. It is now possible to select more than one text item or line. Once selected, changes can be applied to all selected items at one time. For example, the font size of all selected text items can be changed at once.

Each press of an arrow keys moves all selected text items or lines one pixel in the arrow direction.

When more than one text item or line is selected, alignment buttons are provided to align the selected items relative to each other. The alignment option becomes available after clicking the right mouse button or double-clicking the left mouse button.

The Delete key will delete all selected text items or lines. The Paste command will restore the deleted items.

Holding the Ctrl key while resizing a plot prevents the text size from changing proportionally with the plot size. Also in this version, the text within a plot will be moved to appropriate locations in the plot if the scale on the X or Y axis is changed.

> Version 4.715 3/01/98
Two new built-in functions have been added.
Erfc(X) is the complement to the Error function equal to 1 - erf(X).
CIS(theta) is a short way of entering COS(Theta)+i*SIN(Theta).

> Version 4.710 2/21/98
The psychrometric chart produced by the Property Plot command now allows the user to enter the lower and upper temperature limits for the abcissa.

> Version 4.700 1/23/98 - 2/2/98 32-bit only)
The keyword Subprogram has been changed to Module. Modules no longer require a colon to distinguish inputs from outputs. Commas are used to separate the arguments. The entire Module concept has been revised. When a Module is called, the equations in the Module are transparently grafted into the equations in the main EES program. The result can be seen in the Residuals window which lists all of the equations that are solved more in less in the order that EES solves them. Additional information is provided in the online help.

> (Version 4.660 1/12/98 32-bit only)
EES now can solve equations with complex variables. Many changes have been made to support this capability. For details, look at Complex Numbers in the online-help.

> (Version 4.649 12/25/97 32-bit only)
The number of allowable plot windows has been increased from 5 to 10. The plot windows are accessed with the Plot Windows submenu in the Windows menu. The plot windows can also be accessed with keyboard shortcuts. For example, Ctrl-1 will bring Plot Window 1 to the front. The keyboard shortcuts for all menu commands are shown in the menus.

NOTE: EES versions 4.648 and earlier can only read 5 plot windows. If you save a file having more than 5 plot windows, a General Protection error will result when you attempt to open this file with an older version of EES. EES should, however, then function normally although some of the plots will be lost.

> (Version 4.643 12/05/97 32-bit only)
By popular demand, a control has been added to the Print dialog to allow printing of multiple copies (32-bit version only).

> (Version 4.634 11/09/97)
It is now possible to display gridlines on plots at positions between the axis numbers. To change the appearance of an axis display, double-click the left mouse button (or click the right mouse button) on the axis. The Modifiy Axis dialog will appear. Select the Grid lines control, if it is not already checked. The # Ticks/Division should appear within a rectangle. Clicking the left mouse button within this rectangle will cause the display to change to # Grids/Division. In this case, grid lines instead of tick marks will be displayed.

> (Version 4.625 10/20/97 32-bit only)
Great news for Europeans! EES is now able to represent numerical values using a comma rather than a decimal point as the decimal separator. To invoke this capability, you must set the Decimal Symbol in the Number tab of the Windows Control Panel Regional Setting dialog window to a comma. Then start EES. EES will automatically convert the format of all values in previously saved files. The comma is now the decimal separator. The list separator character, which in the U.S. version is a character, is now a semicolon. The semicolon in the U.S. version was used to allow multiple equations to be place on one line. Use the period character for this purpose.

> (Version 4.616 9/30/97)

Uncertainty analysis has been implemented. The Uncertainty analysis commands are in the Calculate menu. The Uncertainty Propagation Table places uncertainty values in the Parametric table. Subsequent plotting allows error bars to be drawn representing the propagated error. See the on-line help for details.

> (Version 4.616 9/30/97)
The column widths in the Parametric, Lookup, and Arrays tables may now be individually changed. To change the column width, move the cursor to the header row and position it over a column divider line. The cursor icon will change to a column size icon. Drag the column divider line to its new position.

> (Version 4.614 9/21/97 32-bit only)
Functions T_crit, P_crit, and v_crit have been added to return the critical temperature, pressure, and specific volume respectively. These functions take one parameter which is the name of the fluid. A string variable can be provided.

> (Version 4.611 9/18/97)
A menu speedbar has been implemented with one-button access to the most commonly applied menu commands. If you wish, you can disable the menu speedbar with the Preferences command in the Options menu by setting the 'Display menu speedbar' control.

> (Version 4.610 9/17/97)
The Default Variable Information command in the Options menu allows the guess values, bounds, display format and units for variables to be automatically set based on the the first letter of the variable. It is now possible to have multiple sets of Default Variable Information by using the Load and Store buttons that have been added to the dialog. Store will store the currently defined defaults in a file having a .dvi filename extension. Load will load a previously-stored file and apply the defaults to all existing and new variables. The EES_DFLT.dvi file contains the variable defaults EES will apply when it is started.

> (Version 4.600 9/01/97 32-bit only)
Property data for R404A, R407C, and R410A have been added. These fluids are quite different from any of the others in the data base in that they are blends. R404A and R410A exhibit very little temperature glide, so its T-s and P-h plots looks like those for a pure fluid. However, the T-s and P-h plots for R407C show the capabilities of the new property functions.

> (Version 4.600 9/01/97 32-bit only)
Modules are now supported. Modules are used exactly in the same manner as procedures. The 'Procedure' keyword is replaced with 'Module'. The Module is accessed with a 'Call' statement. The difference between a Module and Procedure is that the Module can use equality statements, rather than assignment statements as used in Procedures. Each Module has its own set of variables. Each Module can have up to 5000 variables. The guess values for the Modules and main program are accessed with the Variable Info command. See the on-line help for documentation.

> (Version 4.459 8/09/97)
EES will automatically load the HELLO.EES file if it finds this file in the EES main directory. You can place messages, directions, or any information you wish in this file. This file is named HELLO.EES. If you do not with this file to appear when you start EES, rename it or delete it. Alternatively, hold the Shift key down to bypass opening the Hello.EES file.

> (Version 4.458 8/07/97)
Text items and lines/arrows on the plot windows can now be cut and copied to the Clipboard using the commands in the Edit menu. This feature makes it easy to copy text and lines from one EES plot window to another.

> (Version 4.457 8/04/97)
Two new directives have been added:
$Warnings On/Off controls the setting of the Warnings Option in the Preferences dialog
$Arrays On/Off controls whether arrays variables are displayed in a separate Arrays table.
Other directives are $Common, $Include, and $Complex On/Off.

> (Version 4.456 8/02/97)
The height and width of the Variable Info dialog can be changed.

> (Version 4.454 7/30/97)
The Lookup, Interpolate, and Differentiate functions will now accept an ASCII Lookup file, in addition to the binary .LKT file that wasaccepted in previous versions. More information can be found in the online help under topic Lookup File Formats.

> (Version 4.440 07/01/97)
A bullet line type is now provided in the Add Line (Plot Menu) and Add Diagram Line (Options Menu) commands.

A external procedure called JANAF is provided with EES. JANAF provides the specific heat, specific enthalpy, and specific entropy (3rd law reference) as a function of temperature for many substances. The format is:

CALL JANAF(Substance,T: CP,H,S)

More information is available from the Function Info dialog (Options menu). Click the External Procedure button; Then select JANAF and click the Info button.

> (Version 4.430 6/05/97)
Lines and/or arrows to the Diagram window using the Add Diagram Line that has been added to the Options Menu. This command works in exactly the same manner as the Add Line in the Plot menu, except that it draws lines or arrows on the Diagram Window.

> (Version 4.423 5/23/97)
Make Distributable Program now provides controls which can restrict user access to theTables and Plot menus.

> (Version 4.421 05/21/97)
An Apply button has been provided for the Add Diagram Text command Option menu) and the Add Text command (Plot menu) so that multiple text items can be added to the Diagram window or Plot windows, respectively, with one execution of the command.

> (Version 4.420 05/20/97)
EES now provides support for string variables. A string variable is identified with a $ as the last character in its name, as in Basic. String variable can be assigned to string constants which are characters enclosed within single quotes. A string variable can be used wherever character information is normally provided to EES. For example, the following EES equations are now accepted.

```
h=enthalpy(R$,T=100,P=200)
g=interpolate(F$,Col1$, Col2$, Col1$=h)
```

where R$ is a string variable that will be assigned to legal fluid name during execution of the EES program. F$ is the name of a Lookup file stored on disk. Col1$ and Col2$ are string variables for the names of the columns in the Lookup table. String variables can be defined in the Equations Window, in the Parametric Table, or in the Diagram Window.

> (Version 4.383 02/28/97)
The capabilities of the $INCLUDE directive have been expanded to allow library files, as well as text files to be automatically loaded. EES now provides a Browse option if the file indicated in the $INCLUDE directive can not be found.

> (Version 4.380 02/23/97)
The Debug window has been changed to provide more useful information. The Debug window is accessible when you try to solve a set of equations which has a different number of equations than unknowns. The Debug window shows a listing of all variables which are used only once in the Equations window. A mistyped variable will often be in this category. In addition, EES will now try to identify which variables are likely to be involved in an overdefined or underdefined problems. The Residuals window can now be accessed even if the solution was not successful. The Residuals window provides information on the blocking and order of solution of the equations which may be useful in debugging your problems.

>Help files provided for external functions and procedures can now be either ASCII help files or Windows.HLP files. In either case, the filename extension should be .HLP. EES will determine whether the file is a Windows HLP file.

>The Solutions window has been changed to simplify the process of entering units or changing display format. Clicking the left mouse button on a variable name now selects that variable name which is shown in inverse video. To unselect it, click it again. Multiple variable names can be selected. Pressing the Enter key, double-clicking the left mouse button on a variable name or clicking the right mouse button will bring up a dialog window in which format specifications can be entered. These format specifications will be applied to ALL selected variables.

>New formatting options have been provided. Appending _dot to a variable name will cause that variable to be displayed in the Formatted Equations, Solution, and Parametric Table with a dot centered over the name. For example, T_dot will display as T with a dot centered above the T. Similarily, T_bar will display a bar centered over the T. T_infinity will display a subscripted infinity symbol. DELTAT will display the a Greek Delta followed by T.

>Clipboard operations have been improved. When the Solution Window is foremost, the Copy command will place a picture of the selected variables in Solution window on the clipboard, as well as the text version of the solution. You can copy either the text or the picture to another application using that application's Paste Special command. Similarly, the selected equations and comments appearing in the Formatted Equations window can be copied as a picture to the Clipboard. The Select All will appear as Select Display when the Formatted Equations window or the Solution Window is foremost. This command will select all visible items in the window.

> An Apply button has been added to the Modify Plot dialog window. Clicking the Apply button shows any changes that have been made without exiting the Modify Plot dialog. The characteristics of multiple plot lines can be made at once in this manner. The OK button accepts all changes that have been made. Cancel restores the plot window to the condition it was in before the Modify Plot dialog was started.

> The MIN and MAX functions formally required two arguments. They have been modified to accept 1 or more arguments and return the minimum or maximum value, respectively.

> (Version 4.384 3/3/97)
A new form for the INTEGRAL function has been implemented which allows differential and integral functions to be solved without use of the Parametric table. The format for the equation-based INTEGRAL function is: y = y0 + INTEGRAL(fxy, x, lowx, highx, stepx). y0 is the initial value of y. fxy is an EES variable or expression representing the integrand. The integration variable is x and it is integrated between values lowx and highx. Stepx is optional. If stepx is not provided, EES will use an automatic-step size adjustment algorithm. The value of the integral is determined numerically. Additional examples, DRAG.EES, SUBSTEPS.EES, and DBL_INTG.EES have been added to illustrate the use of the INTEGRAL function. See the on-line help for a more detailed explanation of the expanded capabilities of the INTEGRAL function.

> Default options for the plots, such as the plot size and axis scale attributes can now be specified in the Plot Options section of the Preferences dialog.

> Double-clicking the left mouse button (or clicking the right mouse button) on an equation in the Residuals window will cause the Equations window to be moved to the front with the selected equation highlighted.

Ø A new formatting option has been added. This formatting option, called Automatic, selects the style and number of digits depending on the magnitude of the number. This option should make it unnecessary for the user to select Fixed Decimal or Exponential format, except when a particular format is needed. The Automatic formatting option is now the default for any new variables. Variables defined in problems written in older versions of EES will have the formatting options selected as previously specified. The formatting option can be changed by clicking on the variable in the Solutions window or by use of the Variable Info command in the Options menu. If you hold the Ctrl key down while changing a formatting option, all variables below the one being changed will also be changed. The Automatic formatting option can also be used for the numbers on the axes of plots.
Ø

> New functions INTERPOLATE and DIFFERENTIATE have been added to provide interpolation or numerical differentiation of tabular data. The data normally reside in the Lookup Table, but these functions can also access data in Lookup files or the Parametric table. The format of the INTERPOLATE command is

g = INTERPOLATE('C:myFile',' Col1', 'Col2', Col2=2.34)

The first parameter shown in the above example is optional. If present, it must be the DOS name of an existing Lookup file previously saved with the Save Lookup Table command. Col1 and Col2 are the names of the columns from which data are to be interpolate. The single quotes around the column name are optional. The final parameter indicates whether a value in the first or second column is specified. As shown above, an interpolate value from Col1 will be found corresponding to a value of 2.34 for Col2.

The DIFFERENTIATE command returns d(Col1)/ d(Col2). It has the same format as the INTERPOLATE command. See the online help for additional information.

> Clicking on the column header in the Parametric, Lookup, or Arrays table brings up a dialog window which allows the characteristics of that column to be changed. A new control has been added to this dialog window to select the back color for data in the column. The back color can be used to simply highlight the data, or for other purposes, such as to indicate which columns require data input.

> A unit conversions function has been added to EES. The CONVERT function takes two string parameters and returns the factor to convert from the units represented by the first string to that represented by the second string. As an example, the following equation would convert a heat transfer coefficient from English to SI units.

h_SI = h_Eng * Convert('Btu/hr-ft^2-R', 'W/m^2-K')

Note that the single quotes and the ^ symbol are optional. Additional unit definitions can be added to the UNITS.TXT file in the EESW directory. See the online help for additional information.

>The columns in Parametric table can now be reordered using the Insert/Delete Vars command in the Tables menu. The order of the columns in the Parametric table is controlled by the order of the variables in the Table Variables list. The order of the variables in the Table Variables list can now be changed using the drag and drop feature. To change the column position of a variable, click on its name and then hold the mouse button down while sliding it to a new position.

> It is now possible to control the foreground and background colors of the text displayed in the Solutions window. To change the color, click on a variable in the Solution window. A dialog window will appear in which the colors can be changed.

> EES can read an ASCII text file (with a .TXT extension) into a Lookup table. In this case, the first line of the file must contain the number of rows and columns in the table. If a negative number is provided for the number of rows, EES will determine the number of rows of data in the file and use that number for creating the table. If the number of columns is a negative number, EES will use the absolute value of this number for the number of columns and expect to find the format specification (e.g. F3 or E4) followed by one space and then the column heading and units for each column on following lines . The units are enclosed in square brackets. Following lines contain the data for each row, separated by one or more spaces. The example below would create a table with 2 rows and 3 columns when read in with the Open Lookup command in the Tables menu. The columns would be formatted with E4, F0, and F3 format specifications and the column names will be ColA, ColB, and ColC.

```
 -1     -3
E4 ColA [Btu]
F0 ColB
F3 ColC
1.23E-12            2       4.56 2.34E-11      4       7.89
```

>The MolarMass property function has been implemented. This function takes one argument, the name of the fluid, and returns the molar mass (commonly called the molecular weight). Here is an example:
m11=MolarMass(R11)

>EES now offers the option of bar plots. A bar plot is produced if the plot symbol is chosen to be the open or filled bars presented at the bottom of the plot symbol list.

>Suppose you wish to change every occurrence of variable X1 to X_1 to take advantage of EES's ability to display subscripts. You could do a global change and replace, but then you would also have to reenter the guess values, limits, and units for the new variable X_1. And if X1 appears in the Parametric table, you would have to remove it and add X_1. However, there is now an easier way. You can simply edit the variable name in the Variable Info dialog window and EES will make all of these changes for you.

>The Solution Window will now display subscripts and superscripts for units. For example, m^2 will appear with a superscript 2 if the 'Display Subscripts and Greek Symbols' option is selected in the General Display section of the Preferences dialog. An underscore character indicates subscript as in lb_m.

> A Print Preview button has been added to the Print dialog window.

> An Add Legend Item check box has been added to the New Plot and Overlay Plot dialog windows. If this control is checked, a text item will be automatically generated with the name of the Y-axis variable. The text item will be associated with the line type and symbol selected for the plot line. The feature makes the generation of a plot legend more convenient. The text item is placed at the upper left of the plot. It can then be dragged to any location.

> Clicking the right mouse button in the Equations window will either insert or remove curly brace comments around the selected text. If the selected text is already commented, i.e., begins with a left brace and ends with a right brace, the comments will be removed - otherwise the braces will be inserted.

> Previous versions of EES have allowed the user to add fluid property data with the Martin-Hou equation of state as explained in Appendix D. It is now possible to add additional JANAF table data as well, by placing a file with the appropriate coefficients in the USERLIB sub-directory. The file must have a .IDG filename extension. The file TESTIDG.IDG in the USERLIB sub-directory provides data for CO2 with comments to explain the file format.

> The ERROR procedure now accepts an optional error message string. See the online help for the syntax and an example.

> A snap-to-grid option has been provided for moving text on the plot and diagram windows. The snap to grid option is set in the Preferences window. Holding the Ctrl key down while moving text disables the snap to grid option.

> Internal EES functions and procedures can now make use of the $COMMON directive to pass information from the main program. The $COMMON statement must follow the FUNCTION or PROCEDURE declaration. The $COMMON directive should be the first item to appear on the line. Variables appearing in the $COMMON statement are separated with commas, as in this example.

```
FUNCTION  TESTCOMMON(X)
$COMMON B,C,D {variables B,C, and D are from the main program}    TESTCOMMON:=X+B+C+D
 END
 B=4;  C=5;  D=6
 G=TESTCOMMON(3)
```