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LTCP 2D GRAPHICAL USER INTERFACE

APPLICATION DESCRIPTION AND USER'S GUIDE

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LTCP 2D GRAPHICAL USER INTERFACE

APPLICATION DESCRIPTION AND USER'S GUIDE

INTRODUCTION

The purpose of this document is to provide a description for a graphical user interface (GUI) written for the LTCP 2 dimensional computational fluid dynamic code. Herein, the reader will first find a brief description of the program and its capabilities. Following, the document provides a detailed description of each menu selection and summarizes the method of creating an input file for LTCP. A cross reference is included to help experienced users quickly find the variables which commonly need changes. In addition, contact information is provided for those occasions when assistance is required. Finally, the system requirements and installation instructions provide the information needed when one is just getting started.

The GUI provides a simple means to generate an input file for the LTCP code. The GUI provides this interface through code written in C^{++} for a desktop personal computer running under a Microsoft Windows[1] operating environment. Through the use of common and familiar dialog boxes, features, and tools, the user can easily and quickly create and modify input files for the LTCP code. In addition, old input files used with the LTCP code can be

[1] Windows is a trademark of the Microsoft Corporation.

opened and modified using the graphical user interface. The GUI is designed so that input variables with common topics are specified in common areas, so a minimum of key strokes or mouse operations is required for iterative type analysis routines.

Several assumptions are made regarding the reader and the equipment available for running the GUI. First, it is assumed that the user has at least a beginning knowledge of the Windows environment and can reliably manipulate a mouse pointer for Windows functions. In addition, the user must have a strong background in the use of the LTCP 2 dimensional CFD code, its input requirements, and its output functionality.

DESCRIPTION OF THE APPLICATION

The purpose for generating a program for creation of a input file is to make the task of generating an input file easier and faster. The LTCP GUI was written keeping this idea in mind. First, the menu system is structured so that it first divides the input variables by the namelist in which they fall (e.g. $DATA or $COMBST), by having a menu for each of the namelists: $DATA, $WALDAT, $COMBST, $CHEM, and $BCON. Second, the variables are divided into sub-topics which form the menu selections. For example, a variable within the $DATA namelist having to do with the specification of printout information is contained in the dialog box created by the "printout" selection on the $DATA menu.

The functionality provided for each of the menu selections was kept as standard as possible throughout the application. Standard dialog boxes (identical to those the user will have seen in other Microsoft Windows applications) are used wherever possible, and detailed description of those menu selections will not be provided. In addition, the remaining menu selections produce the same basic results; a dialog box is presented, the users inputs the appropriate information, clicks on OK and the data is transferred to the input file buffer.

The dialog boxes for the application all have a similar appearance as well. Data entered by the user is provide through keystroke for double precision variables and through mouse selections for integer parameters. In addition, all the custom application dialog boxes have the same basic functions. Each dialog box will include varying numbers of text edit boxes and radio-buttons, as well as an OK, Cancel, Defaults, and Clear button. The OK, Cancel, Defaults, and Clear buttons perform the same function within each dialog box throughout the application.

DOUBLE BUFFERED DATA

An important feature of the program, and one which is important for the user to understand, is the "double-buffering" approach to the input data generation. There are two buffers for each input variable which hold information which could potentially become part of the input file. For this document, the buffers will be referred as the new buffer, and the old buffer. The old buffer is the buffer which default data is loaded into upon start-up of the application, or implementation of the File-New menu command. The default data is retrieved from a file called "defaults.dat" which is contained in the same path as the program executable. The default data is stored in the file in a format identical to the input file format, so any input file which can be read by the application can be renamed and replace the defaults.dat file.

The new buffer is initially empty, and is the buffer which the input file is written from. In other words, when the user selects File-Save from the application menu, the data used for writing of the file is retrieved from the new buffer. Data is transferred from the old buffer to the new buffer in one of two ways. First, the user can select menu item File-Load Defaults, which will automatically write all information contained within the old buffer, to the respective data locations in the new buffer. Second, contained within each dialog box is a button labeled "Defaults" which retrieves information about only the data members contained within that dialog box and writes that information in the dialog box controls. It is important to note that this information is ONLY transferred to the new buffer after a dialog box is closed with the OK button. If the Cancel button is used, the new buffer either remains empty, or contains the same information that was previously set in the buffer within the same work session.

STEP BY STEP GUIDE

The following is a step by step guide to using the application. Presenting the information about the application in this format provides the user with not only a step by step approach to using the software, but will help the user understand the inner-workings of the application, and some of the "tricks" of using the program. If your looking for information regarding a specific input variable, please refer to the summary of variables table found in the Appendix A.

The first step is obviously to start the program. This process is very simple, but is covered in this document in a section labeled "Installation and Start-up." As previously described, the default input file is automatically loaded into the old buffer upon program start-up. The next step is to provide the application with information which will be placed in the three title lines provided by the LTCP input file format. Select File-Info from the application menu and a dialog box appears that allows the user to input their name, date, and a job description. The name field allows for a list of names totaling 72 characters, and the description can be up to 72 characters in length. One convenient feature is if the user hits the Defaults button, the Date edit box is loaded with the current date according to the operating system. The remaining information is entered in the Name and Description edit boxes by simply clicking with the mouse over the edit field and entering the data through the keyboard. The data can be accepted by hitting the OK button, or the information can be cleared from the field by hitting the Clear button. If the user wants to leave the dialog box without the changes being implemented in the new buffer, simply press the Cancel button. Once information is entered into the dialog box controls and the OK button is pressed, the information provided through the dialog box appears next to the descriptions on the screen.

Once the information about the input file in entered, it is recommended that the user save the file before further modifications are made. To save the file, select File-Save from the application menu. The dialog presented is the standard dialog box for filename and path specification used in most Windows applications. Enter a filename in the edit box provided for that purpose and hit the OK button. The filename can have a prefix up to eight characters and a suffix of up to three characters.

To start specifying input parameters, select $DATA-Grid Info from the application menu. The user is presented with a dialog box asking for the variable names NCIE, NETA, PU, AL, and NPUP. Since all of these variable require input numbers, the user can simply click over any of the text field and enter the appropriate values. In addition, the user can press the Defaults button and find that the values specified in the defaults.dat file are automatically loaded. Note that when entering numbers in text fields for variables that should be integer values, only the 10 number digits are allowed as input. The edit box will not accept any characters, punctuation, or operators. A similar case is provided for double precision input for the ten digits are allowed, as well as the characters . , E e and -, so that the user can specify the information in scientific or engineering formats. Once all the appropriate information is entered in the text field, the user should hit the OK button to accept the information. If the user left the text boxes blank in either the NCIE, NETA, or NPUP text fields, a message box appears that informs the user that the variables must be specified. The user will not be able to leave the dialog box until this information is provided. Since the AL and PU parameters are optional for the LTCP code, these fields can be left blank. Note that after the OK button is pressed and the dialog box is closed, the information is displayed next to the appropriate descriptions. The information displayed is that information which is contained in the new buffer and will be the information that will be written to the input file. The default information is still contained within the old buffer, so if a mistake was made, the defaults can be retrieved by entering the dialog box again, and hitting the Defaults button.

The next step is to specify the phase information about the job to be run. Once the user selects $Data-Phase info from the menu, a dialog box similar to the Grid Information dialog box described above appears. This dialog box has the same OK, Cancel, Defaults, and Clear buttons, however contains a new control called radiobuttons. Radiobuttons are collected in groups and are used to specify input parameters which have a discrete number of options. For example, the TWOPHS variable uses two radio buttons which allow the user to chose between gas phase only or gas and droplet phases. Note that the users cannot select both since turning "on" one radio button in the group turns all others "off." The remaining data uses the same edit box rules as explained with the $DATA-Grid Info dialog box. The defaults button loads the information from the old buffer, accept in the case of the radiobuttons, converts the flags to the actuation of the correct radiobutton. Once the user selects the OK button, the information is again written to the screen next to the description. However, in the case of the radiobutton controls, the data is converted back to the flag format so that the user can see exactly what will be written to the input file.

All remaining data in the $DATA, $WALDAT, and $COMBST namelists are specified in one of the methods described above. The only controls used in the application are the edit boxes and the radiobuttons, keeping the application simple and unambiguous.

The $CHEM namelist data is mostly required within a manually created data file. The only function provided for this namelist is the ability to select the name of this file. It should be noted that the order of species on the species/chemical reaction file MUST be the same as the thermodynamic file. A typical sample of both files is given in Appendix B.

The $BCON namelist is divide up into eight categories: left, right, top, and bottom for the gas phase, and the left, right, top, and bottom for the droplet phase. The eight categories are specified through eight menu items on the $BCON menu. Each of the eight selections provide the same basic functionality. The user is presented with a dialog box which allows the user to specify all of the input parameters of the corresponding boundary. In addition, the dialog box provides edit boxes for specifying which nodes that the information in the dialog box will appear. The nodes are specified in a starting node through ending node format, and the user is only allowed to edit the ending node. Thus, the first time the dialog box is opened, the starting node field shows a "1" and the ending node shows NETA. The user should edit the ending node field and the input parameters, and hit the OK button. If the number in the ending node field is less than NETA, the same dialog box appears, excepting that the starting node field now contains, the ending node field from the previous iteration, plus one. This process will continue until the ending node field reaches NETA.

If the process of specifying the boundary information is terminated before the NETA is reached in the ending node field, the boundary conditions are stored in the new buffer for only those nodes which were specified. In addition, once the user completes the process, the boundary condition information is written in an array format on the screen, exactly how it will appear in the input file.

A final convenient feature of the application is the ability for load the new buffer with all default information. This information can be quickly transferred to the new buffer by selecting the File-Load Defaults menu option. This selection creates a dialog box inquiring if the user is sure that the defaults should be loaded into the new buffer. If the users selects OK, the new buffer will automatically be loaded with all the information contained in the old buffer, which depends on the defaults.dat file. This feature is powerful in iterative type analysis applications when the user can set up their own defaults.dat file and simply wants to change a small number of input parameters without having to go through every menu selection in the application. However, it is important to note that if the Load Defaults feature is used after information has already been specified for the new buffer, that data in the new buffer will be lost.

TECHNICAL SUPPORT

The name and information can be used in the user runs into problems.

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INSTALLATION AND START-UP

The following are the system requirements for installing and running the LTCP GUI.

1. 80386 or higher CPU with at least 4 Mbytes RAM.
2. Approximately 3Mbyte of hard disk space.
3. Microsoft Windows 3.0 or later

The executable and necessary support files are provided on one 3 ½" floppy diskette. The files are compressed in a ZIP file format. The following provides detailed steps for installation of the software:

1. Place the floppy diskette in the disk drive.
2. Go to the C:> prompt and type "mkdir c:\ltcpgui" and press return.
3. While still at the C:> prompt, type "cd C:\ltcpgui" and press return.
4. Type "copy A:\ltcpgui.zip C:\ltcpgui\ltcpgui.zip" and press return.
5. Type "copy A:\pkzunzip.exe C:\ltcpgui\pkunzip.exe" and press return.
6. Type "pkunzip ltcpgui.zip" and press return. The pkunzip executable will extract the files from the "zipped" archive and place them in the ltcpgui directory.

Type "del pkunzip.exe ltcpgui.zip" and press return. This deletes the unnecessary files in directory. To start the application, simply type "ltcp2dgi.exe" and press return.

APPENDIX A

Table I. Variable name and menu location cross reference.

Name List	Variable Name	Menu	Selection	Control Type
N/A	Title	File	Info	edit box
N/A	Title	File	Info	edit box
N/A	Title	File	Info	edit box
$DATA	NCIE	$DATA	Grid Info	edit box
$DATA	NETA	$DATA	Grid Info	edit box
$DATA	PU	$DATA	Grid Info	edit box
$DATA	AL	$DATA	Grid Info	edit box
$DATA	NPUP	$DATA	Grid Info	edit box
$DATA	NITER	$DATA	Steps	edit box
$DATA	F2D	$DATA	Grid Info	Radio
$DATA	NUMFLG	$DATA	Phase Info	Radio
$DATA	EPDEX	$DATA	Phase Info	edit box
$DATA	EPDIMP	$DATA	Phase Info	edit box
$DATA	TWOPHS	$DATA	Phase Info	Radio
$DATA	NUMP	$DATA	Phase Info	Radio
$DATA	EPDEXP	$DATA	Phase Info	edit box
$DATA	EPDIMP	$DATA	Phase Info	edit box
$DATA	CFLIN	$DATA	Steps	Radio
$DATA	ITURB	$DATA	Turbulence	Radio
$DATA	TRBDMP	$DATA	Turbulence	edit box
$DATA	SIGMAE	$DATA	Turbulence	edit box
$DATA	SIGMAK	$DATA	Turbulence	edit box
$DATA	CON1	$DATA	Turbulence	edit box
$DATA	CON2	$DATA	Turbulence	edit box
$DATA	CMU	$DATA	Turbulence	edit box
$DATA	DTI	$DATA	Steps	edit box
$DATA	NDTI	$DATA	Steps	edit box
$DATA	INPGRD	$DATA	Grid	edit box
$DATA	NSP	$DATA	Reference	edit box
$DATA	ALEWIS	$DATA	Reference	edit box
$DATA	IGAS	$DATA	Reference	edit box
$DATA	INIODE	$DATA	Reference	edit box
$DATA	UREF	$DATA	Reference	edit box

Name List	Variable Name	Menu	Selection	Control Type
$DATA	RREF	$DATA	Reference	edit box
$DATA	TREF	$DATA	Reference	edit box
$DATA	RHREF	$DATA	Reference	edit box
$DATA	PRI	$DATA	Reference	edit box
$DATA	GAMPFG	$DATA	Reference	edit box
$DATA	WMPFG	$DATA	Reference	edit box
$DATA	NSTART	$DATA	Steps	Radio
$DATA	AMUREF	$DATA	Reference	edit box
$DATA	TMUREF	$DATA	Reference	edit box
$DATA	OMG	$DATA	Reference	edit box
$DATA	SOR	$DATA	Reference	edit box
$DATA	SORP	$DATA	Reference	edit box
$DATA	NSUB	$DATA	Printout	edit box
$DATA	ASUB(I)	$DATA	Printout	edit box
$DATA	NSUP	$DATA	Printout	edit box
$DATA	ASUP(I)	$DATA	Printout	edit box
$DATA	SPPRT	$DATA	Printout	Radio
$DATA	UPLUS	$DATA	Printout	Radio
$DATA	YPLUS	$DATA	Printout	Radio
$DATA	FMCOOL	$DATA	Cooling	Radio
$DATA	PFM	$DATA	Cooling	edit box
$DATA	TFM	$DATA	Cooling	edit box
$DATA	CMFM	$DATA	Cooling	edit box
$DATA	NPFM	$DATA	Cooling	edit box
$DATA	GAMFM	$DATA	Cooling	edit box
$DATA	CPFM	$DATA	Cooling	edit box
$DATA	SCFM(J,K)	$DATA	Cooling	edit box
$DATA	ALFM	$DATA	Cooling	edit box
$DATA	SLOT	$DATA	Cooling	edit box
$DATA	ANGFM	$DATA	Cooling	edit box
$WALDAT	RSI	$WALDAT	Upstream	edit box
$WALDAT	ECRAT	$WALDAT	Upstream	edit box
$WALDAT	RI	$WALDAT	Upstream	edit box
$WALDAT	THETAI	$WALDAT	Upstream	edit box
$WALDAT	RWTU	$WALDAT	Upstream	edit box
$WALDAT	XMIN	$WALDAT	Upstream	edit box

Name List	Variable Name	Menu	Selection	Control Type
$WALDAT	IADD	$WALDAT	Upstream	Radio
$WALDAT	IWALL	$WALDAT	Exhaust	Radio
$WALDAT	RWTD	$WALDAT	Exhaust	edit box
$WALDAT	THETA	$WALDAT	Exhaust	edit box
$WALDAT	THE	$WALDAT	Exhaust	edit box
$WALDAT	EPS	$WALDAT	Exhaust	edit box
$WALDAT	RMAX	$WALDAT	Exhaust	edit box
$WALDAT	ZMAX	$WALDAT	Exhaust	edit box
$WALDAT	RS(I)	$WALDAT	Exhaust	edit box
$WALDAT	ZS(I)	$WALDAT	Exhaust	edit box
$WALDAT	NWS	$WALDAT	Exhaust	edit box
$WALDAT	STARTL	$WALDAT	Decomposition	Radio
$WALDAT	ZSTART	$WALDAT	Decomposition	edit box
$WALDAT	ZEND	$WALDAT	Decomposition	edit box
$COMBST	IATOM	$COMBST	General	Radio
$COMBST	EVPOPT	$COMBST	General	Radio
$COMBST	RHPINP	$COMBST	General	edit box
$COMBST	RHPMIN	$COMBST	General	edit box
$COMBST	IENGEQ	$COMBST	General	Radio
$COMBST	GROUP	$COMBST	General	Radio
$COMBST	IGROUP	$COMBST	General	edit box
$COMBST	RPMIN	$COMBST	General	edit box
$COMBST	RPIN	$COMBST	General	edit box
$COMBST	FUEL	$COMBST	General	Radio
$COMBST	OXIDE	$COMBST	General	Radio
$COMBST	SIGMAG	$COMBST	General	edit box
$COMBST	IDIF	$COMBST	General	Radio
$COMBST	ITSRCD	$COMBST	General	edit box
$COMBST	CPP(I)	$COMBST	Droplet	edit box
$COMBST	HEAT(I)	$COMBST	Droplet	edit box
$COMBST	TBOIL(I)	$COMBST	Droplet	edit box
$COMBST	RHDRP(I)	$COMBST	Droplet	edit box
$COMBST	XMUJET(I)	$COMBST	Droplet	edit box
$COMBST	SURTEN(I)	$COMBST	Droplet	edit box
$COMBST	UJET(I)	$COMBST	Jet	edit box
$COMBST	TJET(I)	$COMBST	Jet	edit box

Name List	Variable Name	Menu	Selection	Control Type
$COMBST	DJET(I)	$COMBST	Jet	edit box
$COMBST	DGJET	$COMBST	Jet	edit box
$COMBST	RHGJET	$COMBST	Jet	edit box
$COMBST	UGJET	$COMBST	Jet	edit box
$COMBST	ANGJET	$COMBST	Jet	edit box

APPENDIX B

A Typical Chemical Species and Reaction File

```
species
          h2
          o2
          h2o
          h
          o
          oh
reactions
h + h = h2       ,m1, a = 6.4e17, n = 1.0, b = 0.0, (ar) baulch 72 (a) 30u
h + oh = h2o     ,m2, a = 8.4e21, n = 2.0, b = 0.0, (ar) baulch 72 (a) 10u
o + o = o2       ,m3, a = 1.9e13, n = 0.0, b =-1.79,(ar) baulch 76 (a) 10u
o + h = oh       ,m7, a =3.62e18, n = 1.0, b = 0.0, (ar) jensen 78 (b) 30u
end tbr reax
o2 + h = o + oh     , a = 2.2e14, n = 0.0, b =16.8,    baulch 72 (a) 1.5u
h2 + o = h + oh     , a = 1.8e10, n = -1., b = 8.9,    baulch 72 (a) 1.5u
h2 + oh = h2o + h   , a = 2.2e13, n = 0.0, b =5.15,    baulch 72 (a) 2u
oh + oh = h2o + o   , a = 6.3e12, n = 0.0, b =1.09,    baulch 72 (a) 3u
last reax
third body reax rate ratios
m1 = 25*h,4*h2,10*h2o,25*o,25*oh,1.5*o2,
m2 = 12.5*h,5*h2,17*h2o,12.5*o,12.5*oh,6*o2,
m3 = 12.5*h,5*h2,5*h2o,12.5*o,12.5*oh,11*o2,
m7 = 12.5*h,5*h2,5*h2o,12.5*o,12.5*oh,5*o2,
last card
```

A Typical Thermo File

```
   300.000  1000.000  5000.000
h2                 j 3/77h  2.    0.    0.    0.g   300.000  5000.000
  .30558123E+01  .59740400E-03 -.16747471E-08 -.21247544E-10  .25195487E-14
 -.86168476E+03 -.17207073E+01  .29432327E+01  .34815509E-02 -.77713819E-05
  .74997496E-08 -.25203379E-11 -.97695413E+03 -.18186137E+01
o2                 j 3/77o  2.    0.    0.    0.g   300.000  5000.000
  .36122139E+01  .74853166E-03 -.19820647E-06  .33749008E-10 -.23907374E-14
 -.11978151E+04  .36703307E+01  .37837135E+01 -.30233634E-02  .99492751E-05
 -.98189101E-08  .33031825E-11 -.10638107E+04  .36416345E+01
h2o                j 3/79h  2.o   1.    0.    0.g   300.000  5000.000
  .26340654E+01  .31121899E-02 -.90278449E-06  .12673054E-09 -.69164732E-14
 -.29876258E+05  .70823873E+01  .41675564E+01 -.18106868E-02  .59450878E-05
 -.48670871E-08  .15284144E-11 -.30289546E+05 -.73087997E+00
h                  j 3/77h  1.    0.    0.    0.g   300.000  5000.000
  .25000000E+01  .00000000E+00  .00000000E+00  .00000000E+00  .00000000E+00
  .25474390E+05 -.45989841E+00  .25000000E+01  .00000000E+00  .00000000E+00
  .00000000E+00  .00000000E+00  .25474390E+05 -.45989841E+00
o                  j 3/77o  1.    0.    0.    0.g   300.000  5000.000
  .25342961E+01 -.12478170E-04 -.12562724E-07  .69029862E-11 -.63797095E-15
  .29231108E+05  .49628591E+01  .30309401E+01 -.22525853E-02  .39824540E-05
 -.32604921E-08  .10152035E-11  .29136526E+05  .26099342E+01
oh                 j 6/77o  1.h   1.    0.    0.g   300.000  5000.000
  .28897814E+01  .10005879E-02 -.22048807E-06  .20191288E-10 -.39409831E-15
  .38857042E+04  .55566427E+01  .38737300E+01 -.13393772E-02  .16348351E-05
 -.52133639E-09  .41826974E-13  .35802348E+04  .34202406E+00
end                         0.    0.    0.    0.        .000       .000
```

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H-27260D

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5-32551

NASA/MSFC .... Alabama

N/A

Unlimited

A Graphical User Interface (GUI) for NASA's Liquid Thrust Chamber Performance (LTCP) Code is developed. This interface code is written in C++ for a desk top personal computer running under Microsoft Windows operating environment. This GUI will simplify the input file set up process for the LTCP Code. The user can either generate a new input file or edit an existing file. On line information is provided to guide the user throughout the process.

LTCP Code, GUI

Unclassified Unclassified Unclassified 15