

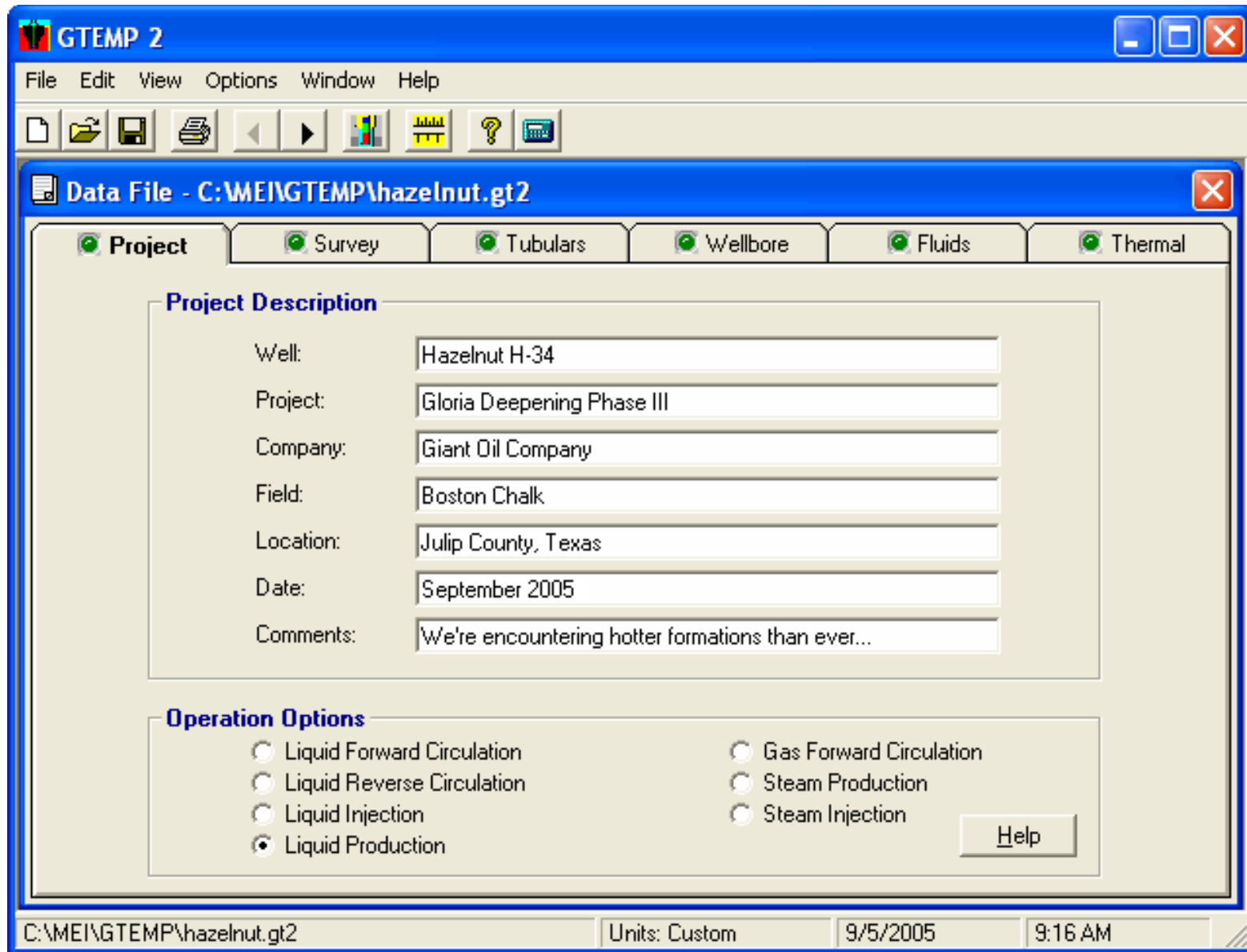
# GTEMP – Wellbore Temperature Simulation Model

is a powerful and efficient tool for analyzing temperature profiles in drilling/completion/production applications. This model was jointly developed by MTI and the Department of Modern Mechanics of the University of Science and Technology of China (USTC).

The program models natural and forced convection, conduction within the wellbore, as well as heat conduction within the surrounding rock formation. A wide variety of well operations can be modeled including:

- liquid or steam injection
- liquid or steam production
- forward and reverse circulation with liquid or gas

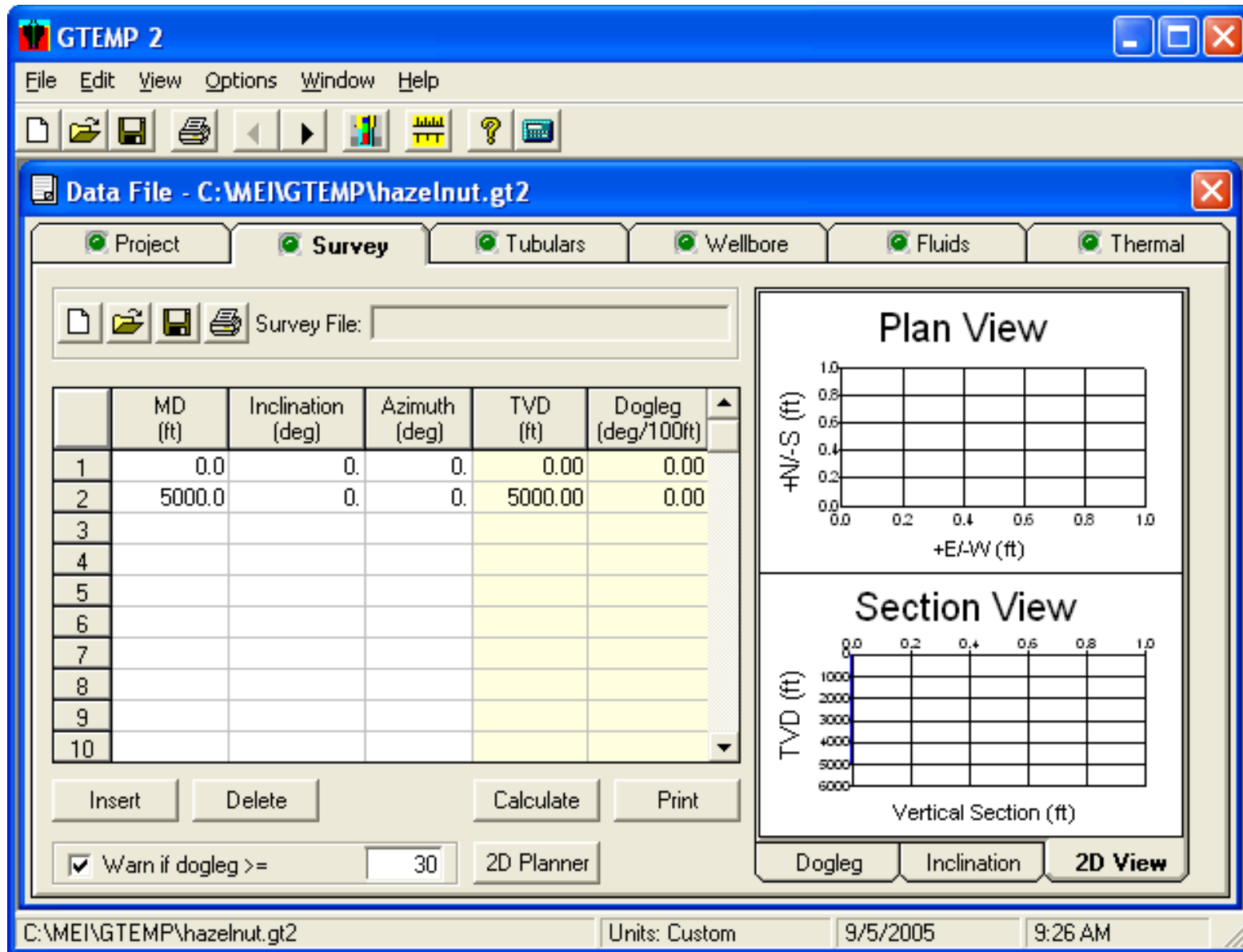
**NOTE:** Computer screens within this PDF document may appear slightly distorted. This is due to limitations in the Adobe Acrobat Viewer when displaying graphics. To clearly view details in the graphics, zoom in or print the document.



**GTEMP**

**GTEMP** is a powerful thermal model with a range of useful features. The first input screen (the Project page) stores project documentation. Select one of seven primary operational modes based on forward circulation, reverse circulation, production or injection.

*Slide  
2 of 17*



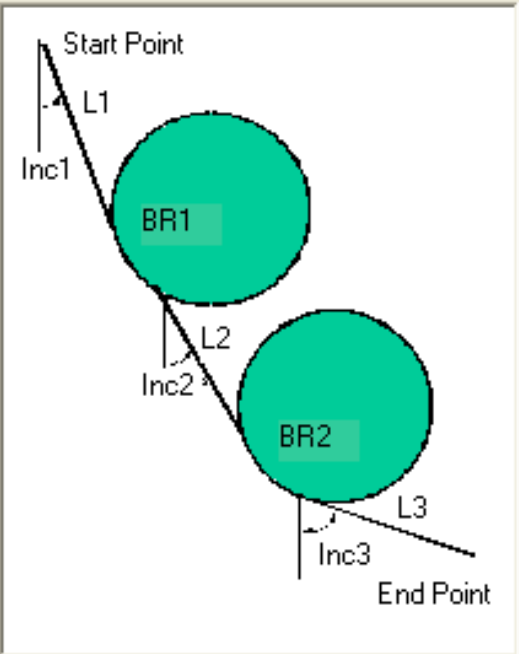
GTEMP

The Survey page displays the wellbore survey that describes the well trajectory. Data may be entered manually, imported, exported, or copied from a spreadsheet. Don't have a survey? Create one quickly with the handy 2D Planner utility.

**2D Well Planner**

**2D Plan**

Build/Build
  Build/Drop
  Build/Hold



**Target**

TVD/NS/EW
  TVD/Horizontal Distance/Azi

TVD (ft): 
 N/S (ft): 
 E/W (ft):

**Planning**

	Unknowns (Select 2)	Value
Inc1 (deg)	<input type="checkbox"/>	5
L1 (KOP) (ft)	<input checked="" type="checkbox"/>	
BR1 (deg/100ft)	<input checked="" type="checkbox"/>	
Inc2 (deg)	<input type="checkbox"/>	60
L2 (ft)	<input type="checkbox"/>	650
BR2 (deg/100ft)	<input type="checkbox"/>	10
Inc3 (deg)	<input type="checkbox"/>	90
L3 (ft)	<input type="checkbox"/>	500

**Survey Interval**

Straight Section (ft): 
 Curve Section (ft):

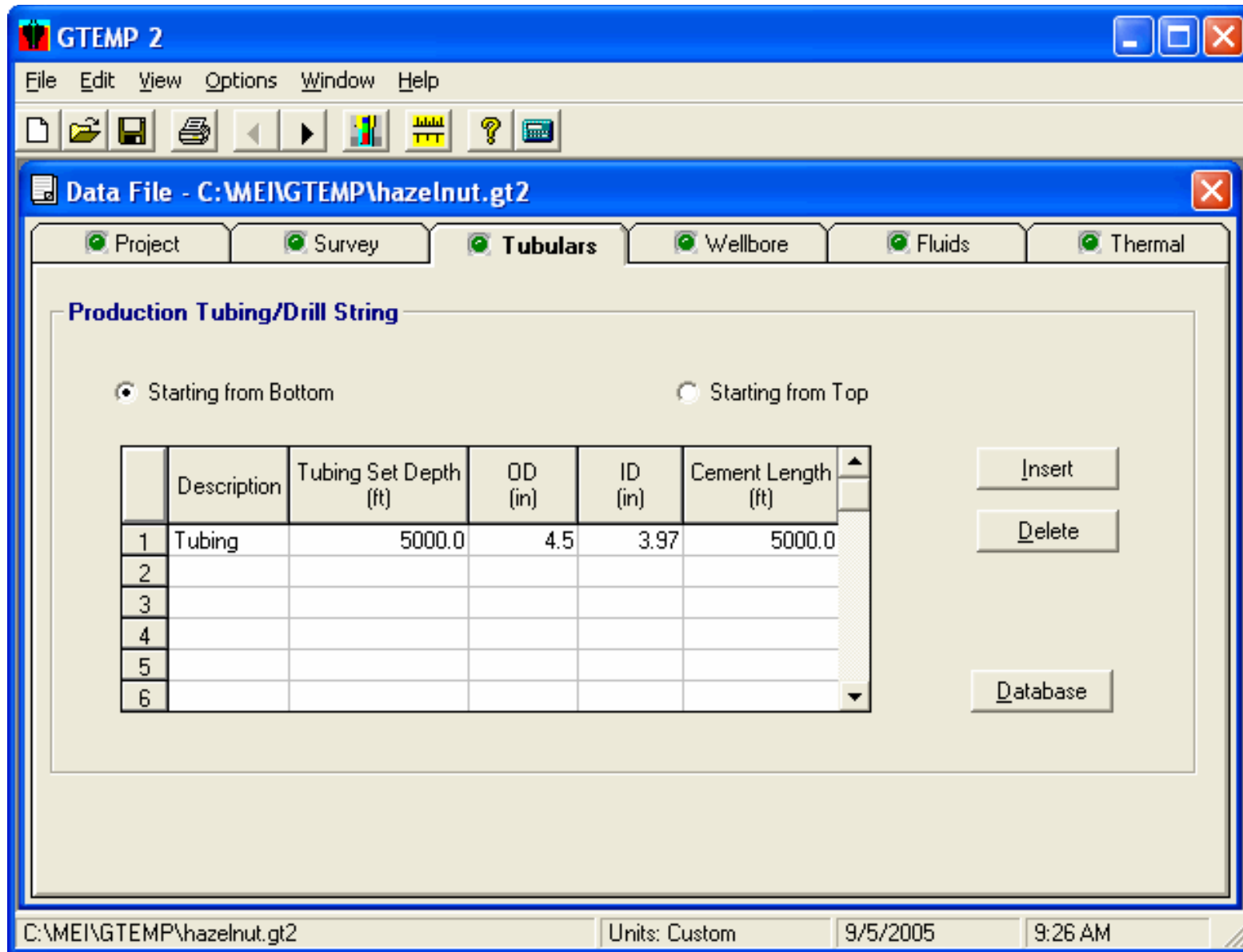
	MD (ft)	Inc (deg)	Azi (deg)	TVD (ft)	N/S (ft)	E/W (ft)	Build Rate (deg/100ft)	Section Length (ft)
1	0.00	5.00	4.29	0.0	0.0	0.0	n/a	n/a
2	893.9	5.00	4.29	890.5	77.7	5.8	0.00	893.9
3	2012.7	60.00	4.29	1798.2	654.4	49.1	4.92	1118.8
4	2662.7	60.00	4.29	2123.2	1215.7	91.2	0.00	650.0
5	2962.7	90.00	4.29	2200.0	2193.8	164.5	10.00	300.0
6	3462.7	90.00	4.29	2200.0	2000.0	150.0	0.00	500.0

Calculate

Accept

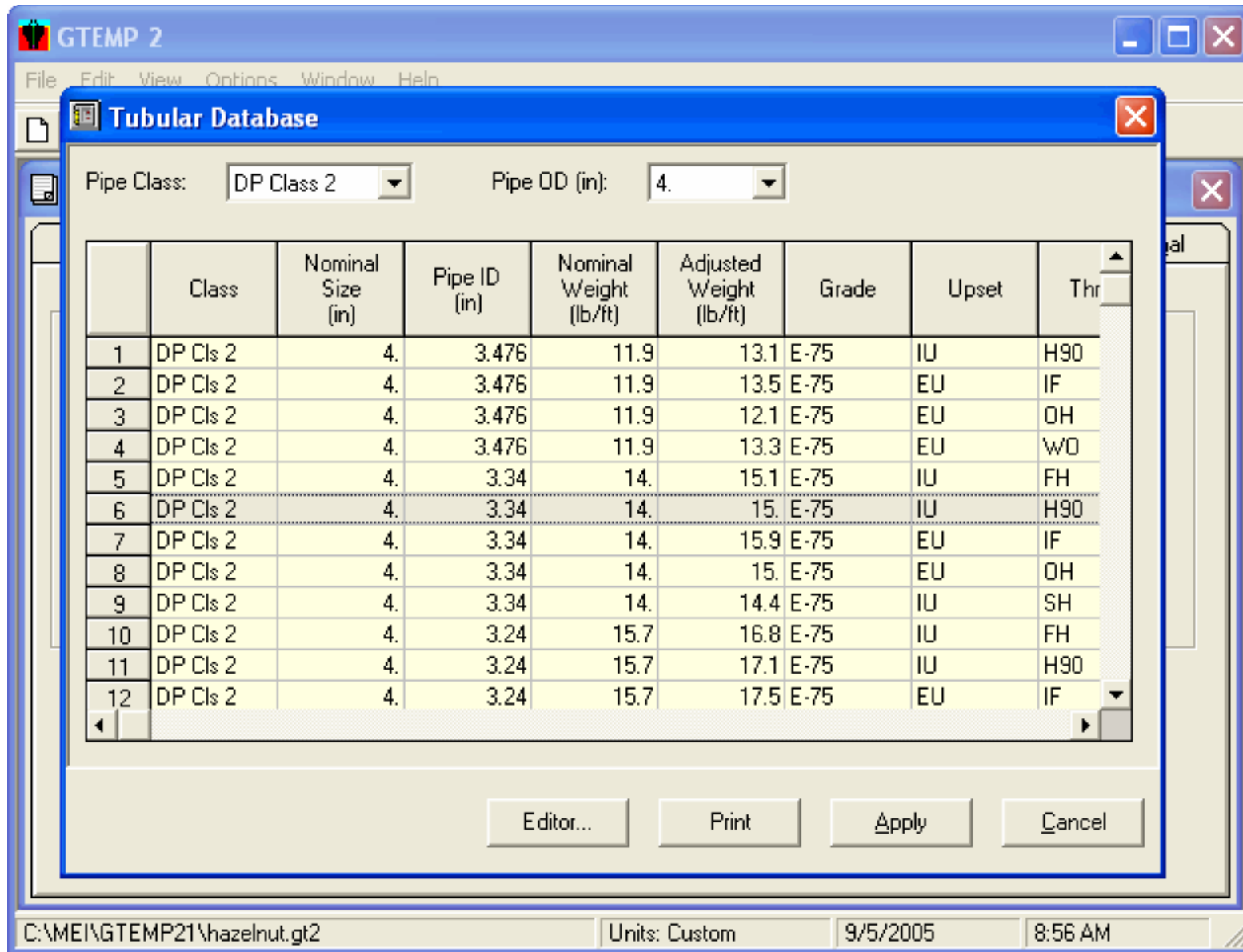
Cancel

The **2D Planner** creates simple or complex well surveys. Choose the basic well shape and enter starting values for the primary geometric parameters. After creation, the new survey is automatically exported back to the Survey page.



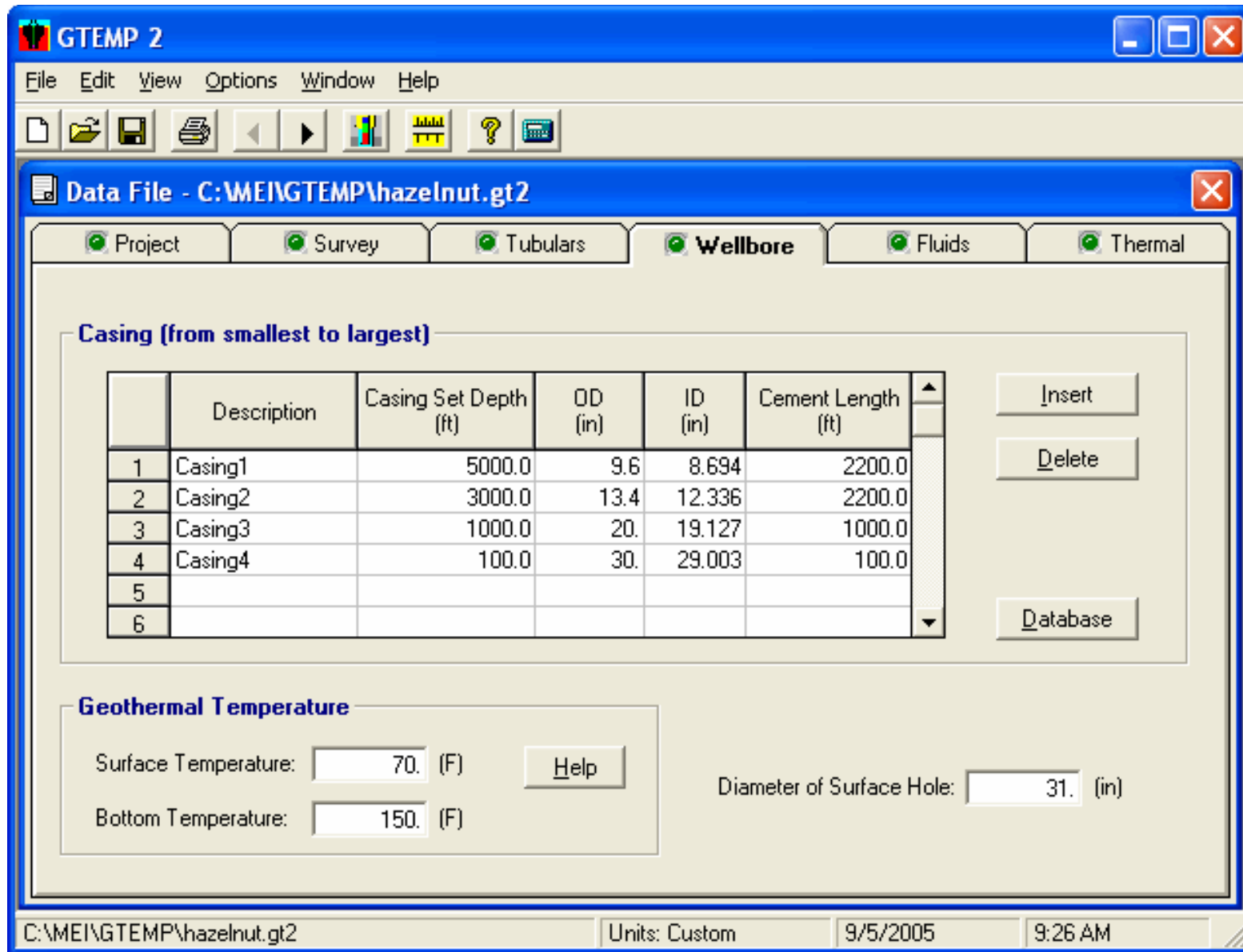
GTEMP

The primary string through which the fluid(s) is to be produced, injected or circulated is specified in detail on the Tubulars page.

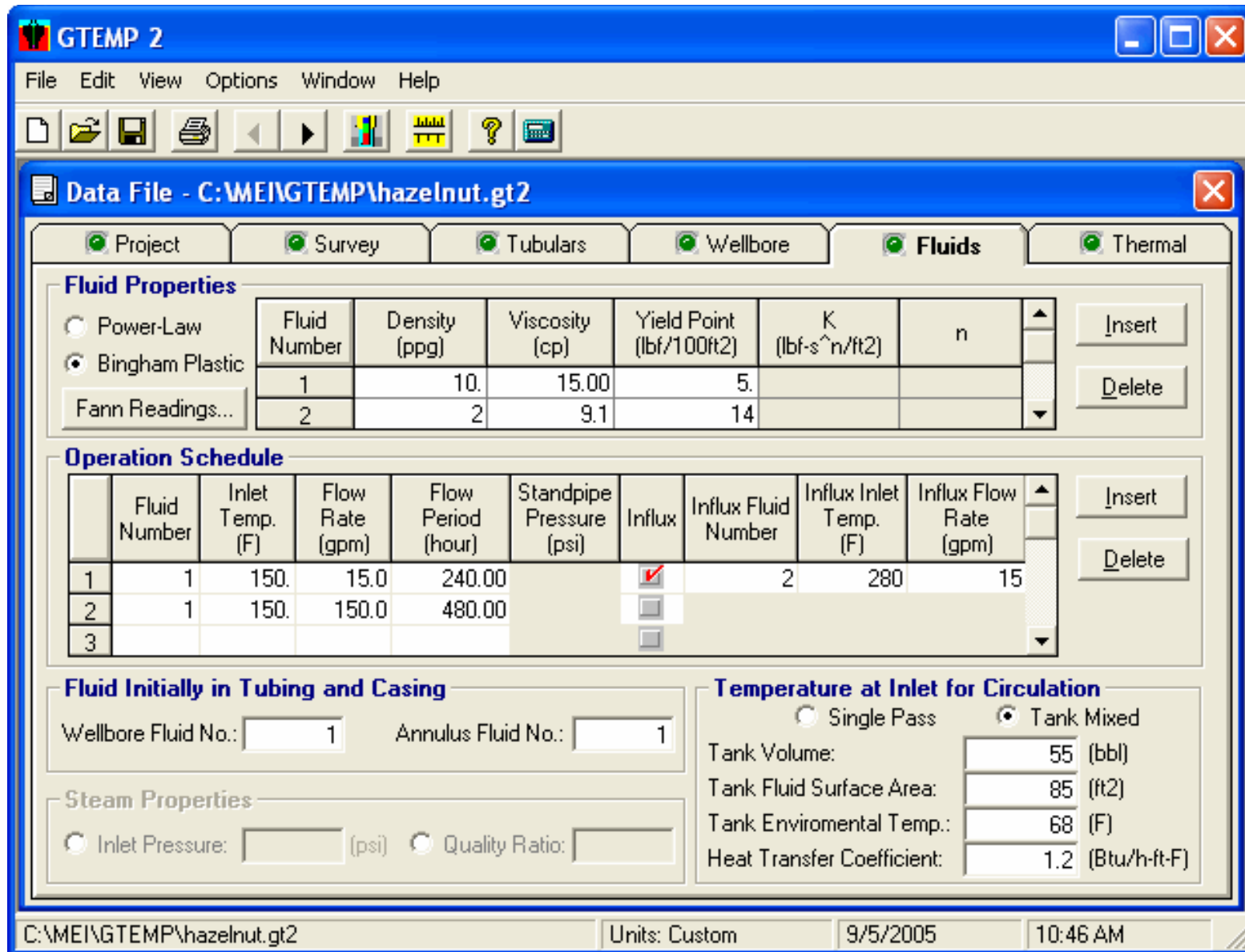


GTEMP

All Maurer Technology programs include an extensive tubular database that may be edited/customized. This feature avoids the need to look up drillstring component sizes, IDs, etc. each time.

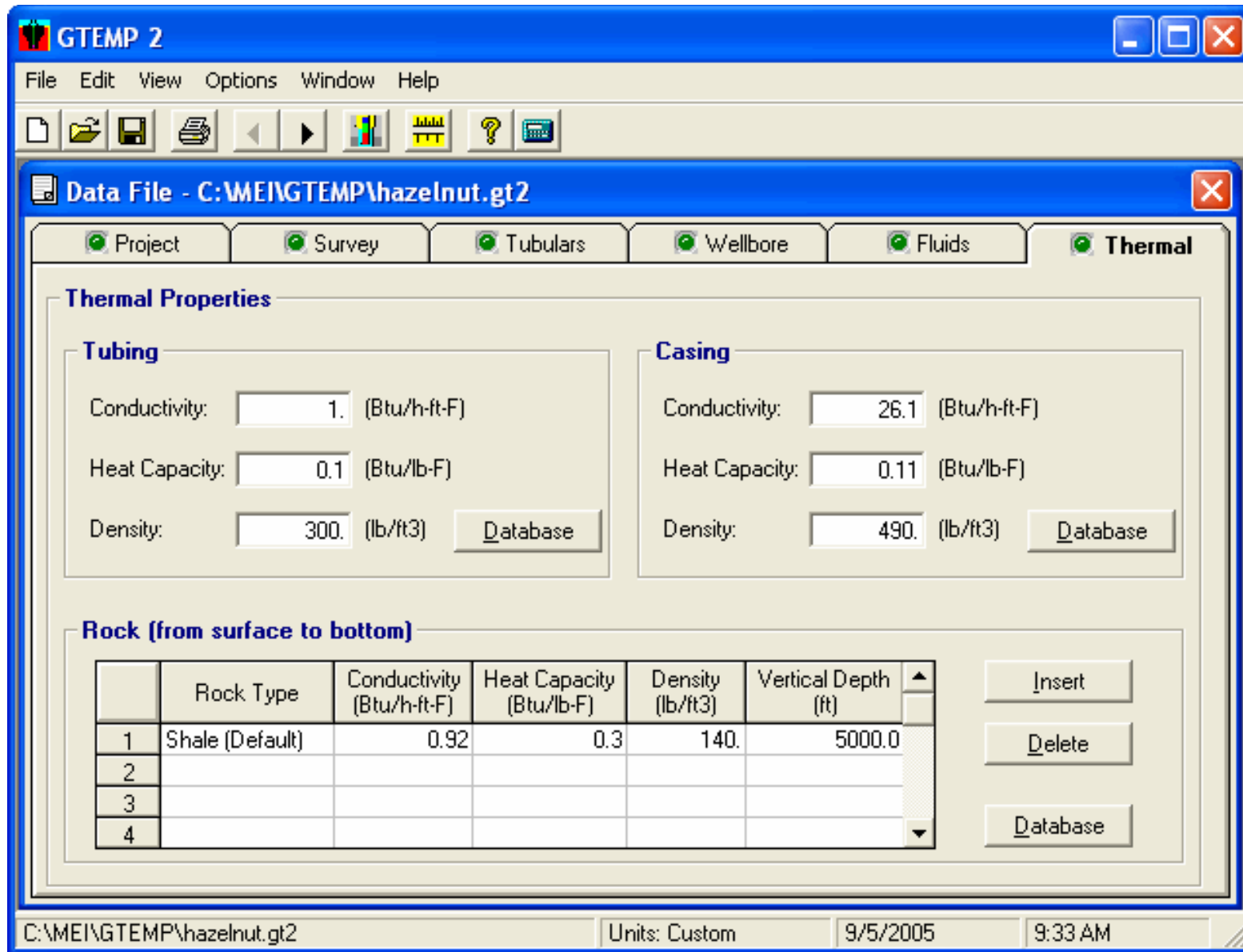


Casing geometry and cement placement along the wellbore must be precisely specified so that thermal conductivity can be calculated. The undisturbed geothermal temperatures at the surface and at the bottom of the hole provide boundary conditions.

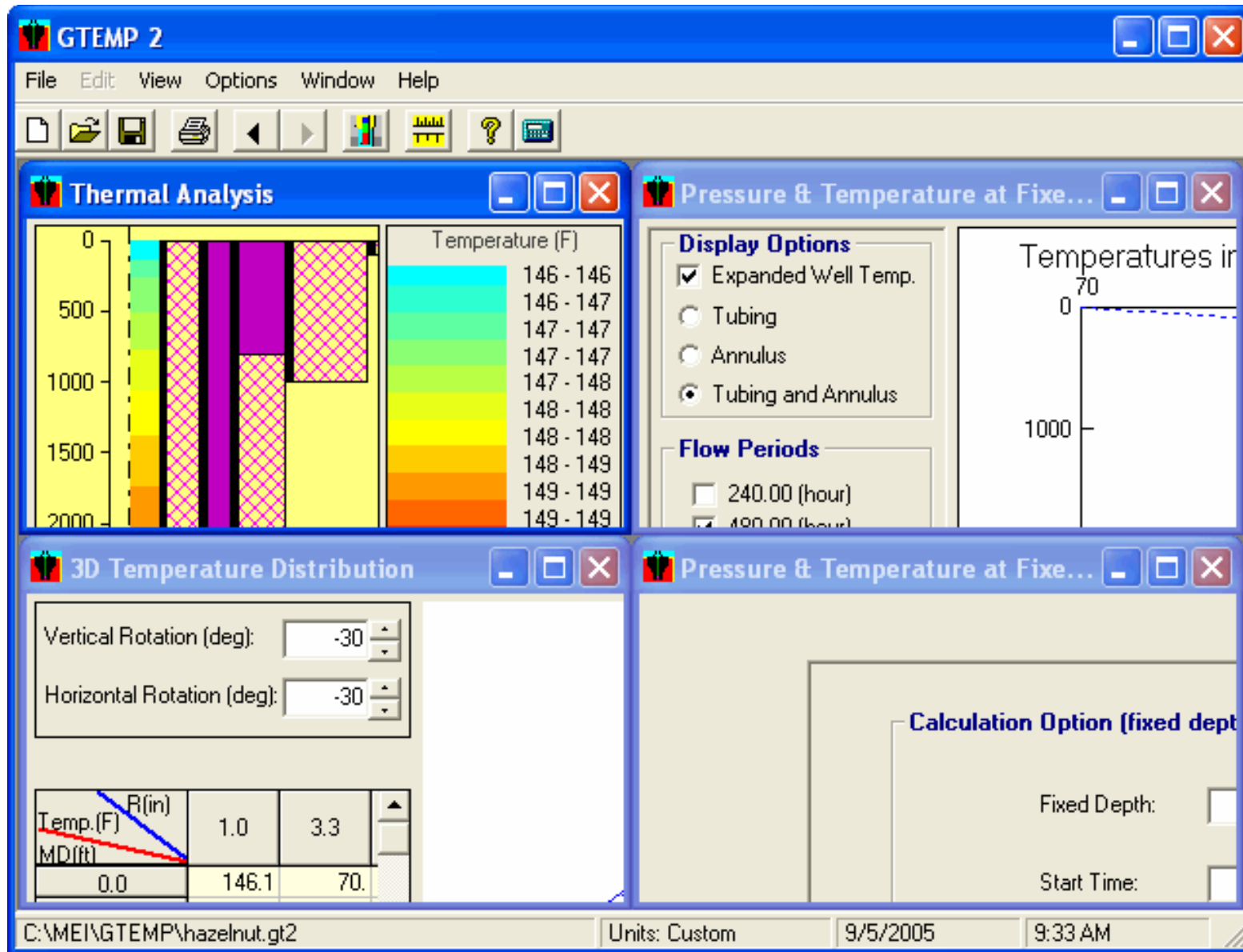


GTEMP

Fluids that are circulated, produced or injected are listed on the Fluids page. Simple or complicated pumping schedules are easy to describe. You can also include thermal energy that is lost when circulated fluid is in the surface tanks.

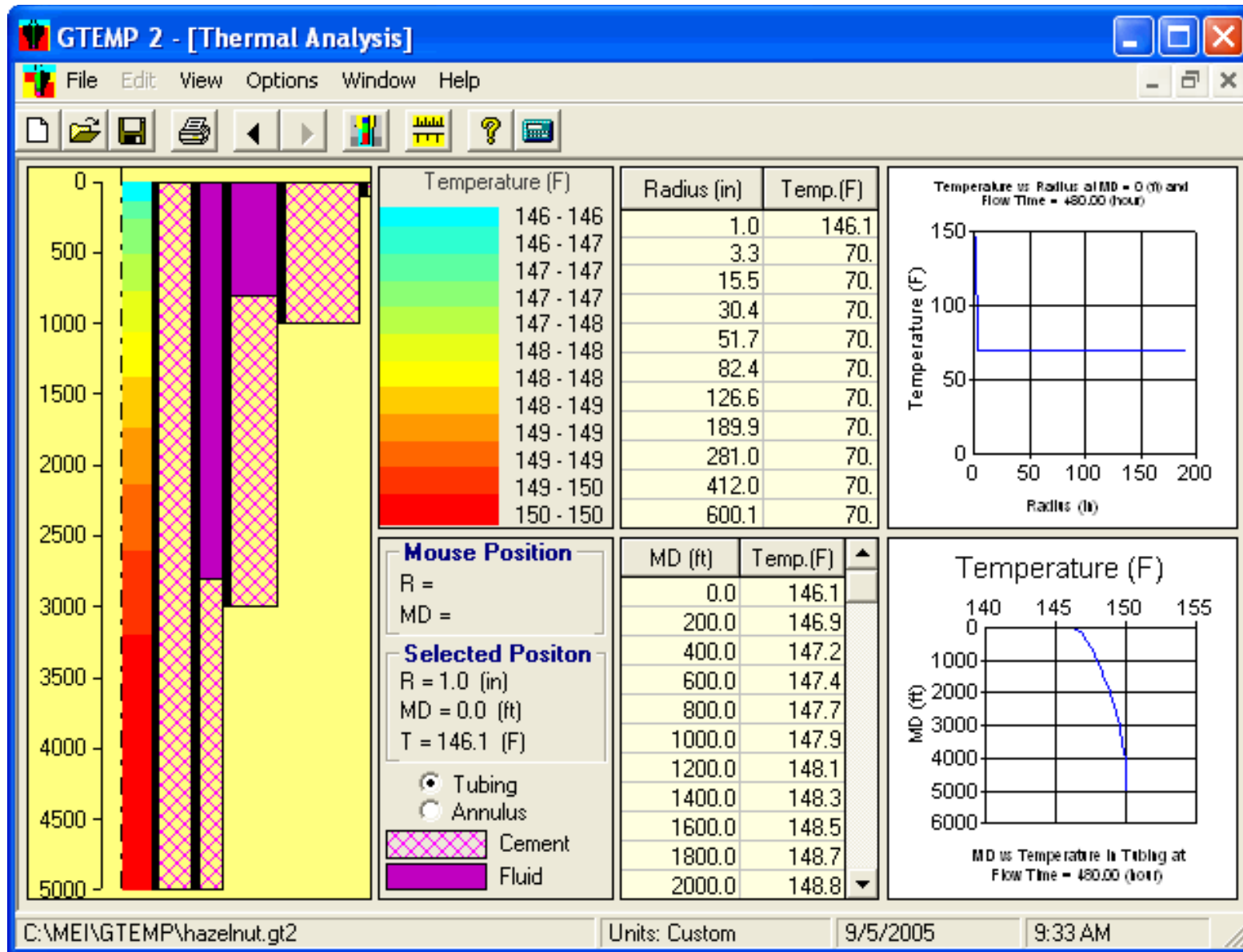


On the Thermal page, enter thermal properties for the tubing material (i.e., production tubing or drill pipe), casing string, and rock layers. Click [Database] to view and select representative data for several common metals and rocks.



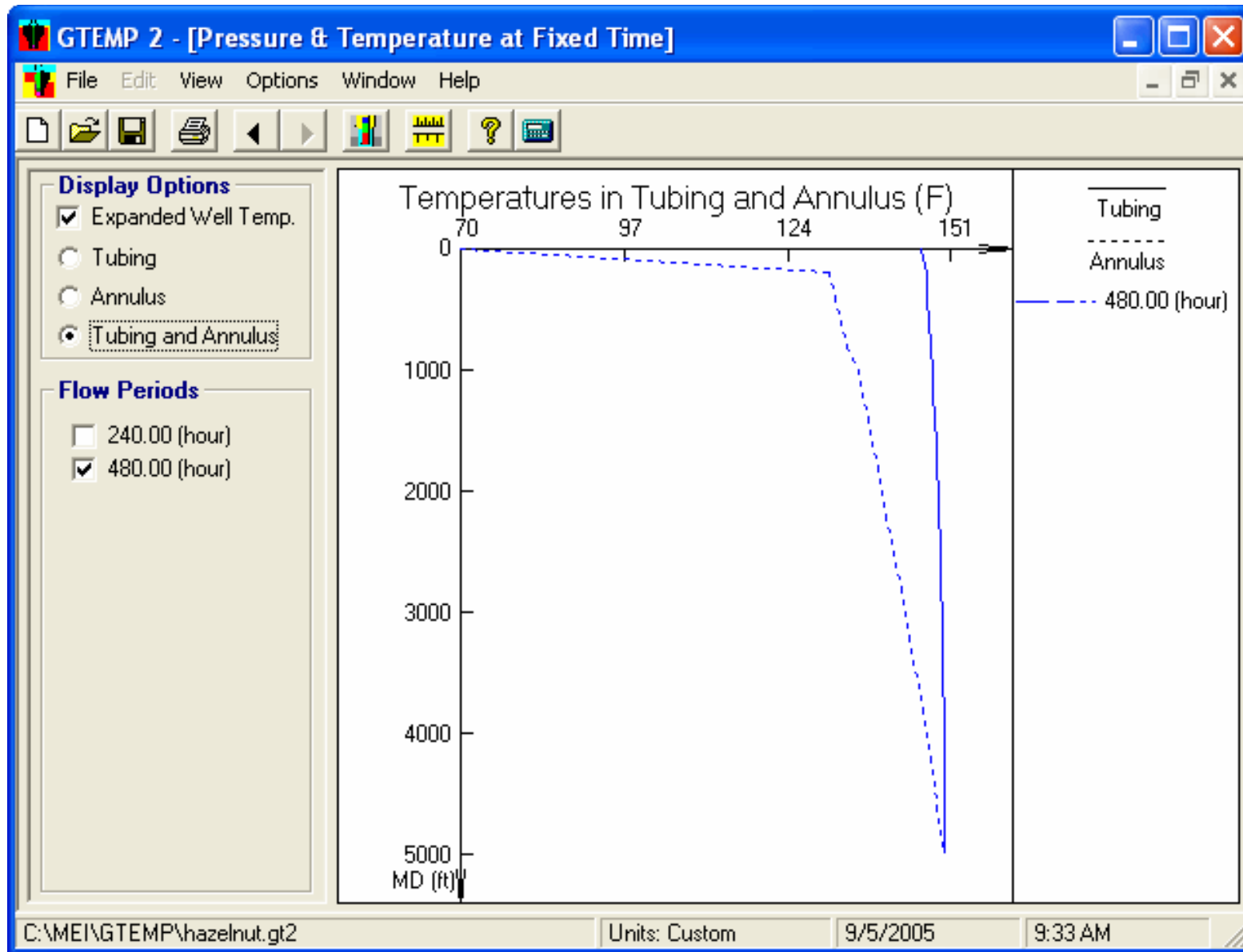
GTEMP

After all required input data are input, the Output window is loaded. Four graphics windows are displayed in a tiled view. These are described on the next four slides.



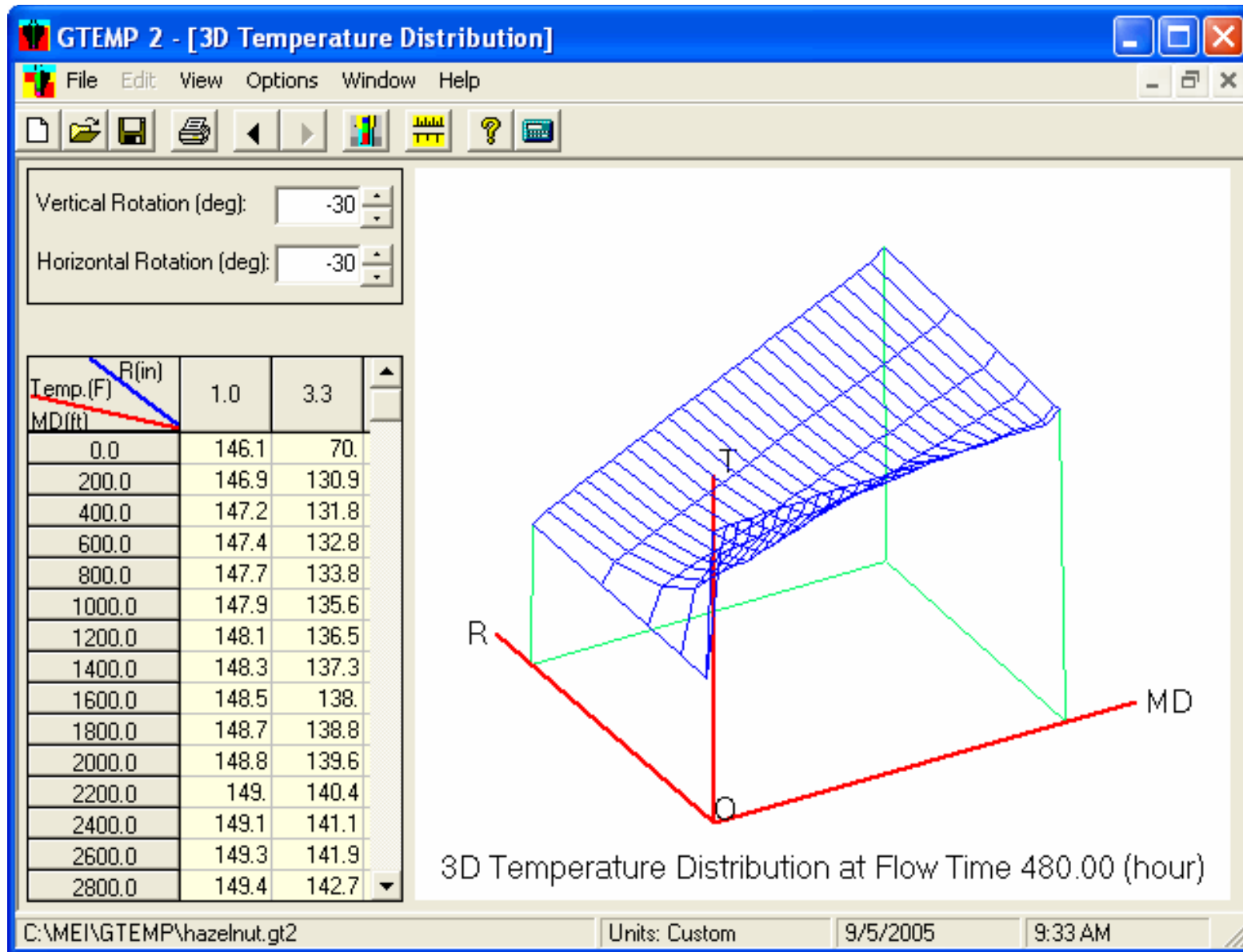
GTEMP

The **Thermal Analysis** window is an interactive graph that allows you to point to any depth of interest on the color-coded wellbore thermal graph. Tables and plots show results at your selected depth.



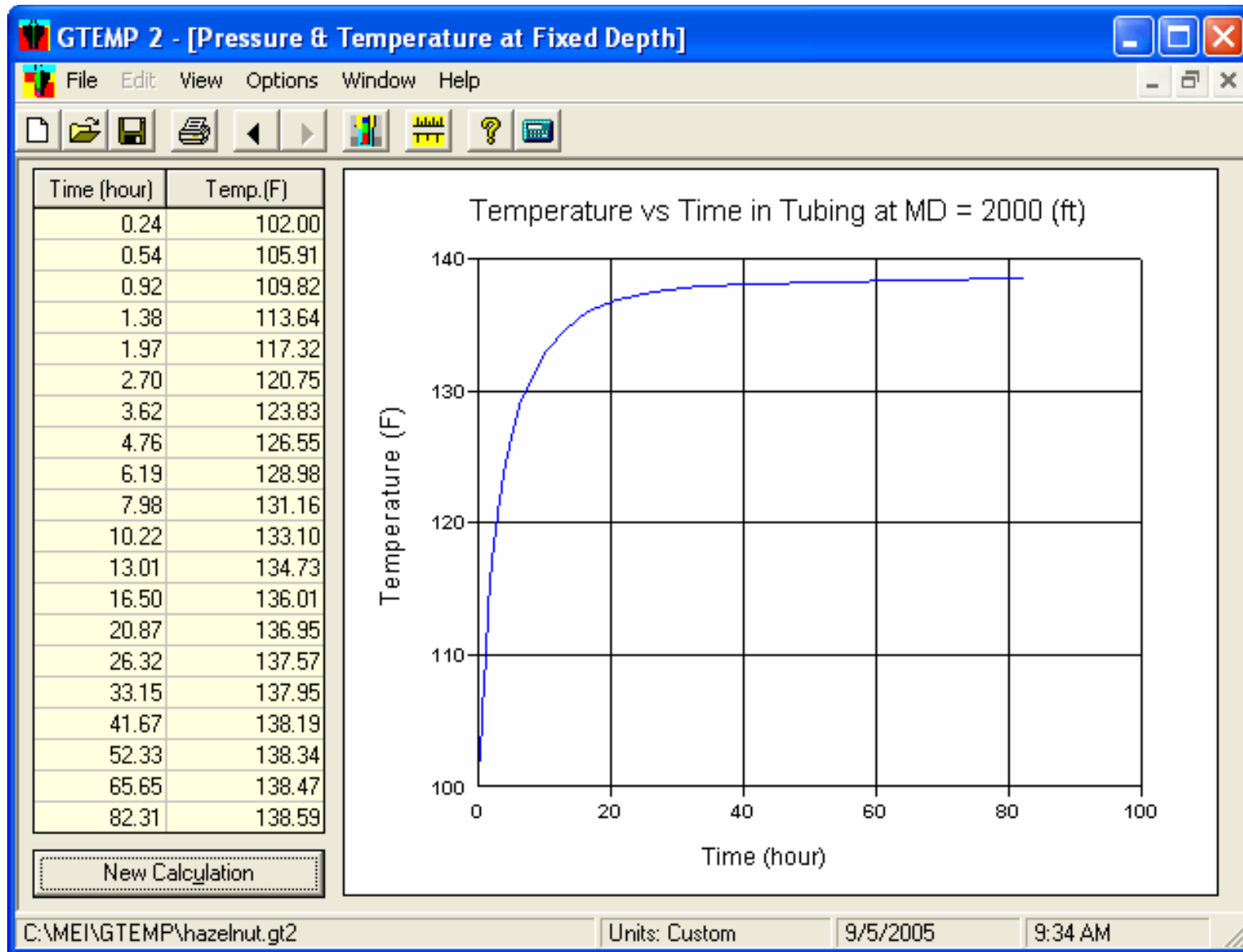
GTEMP

The **Pressure and Temperature at Fixed Time** window is a graph of temperatures along the tubing and annulus at the end of any of the flow stages you specified for your operation.



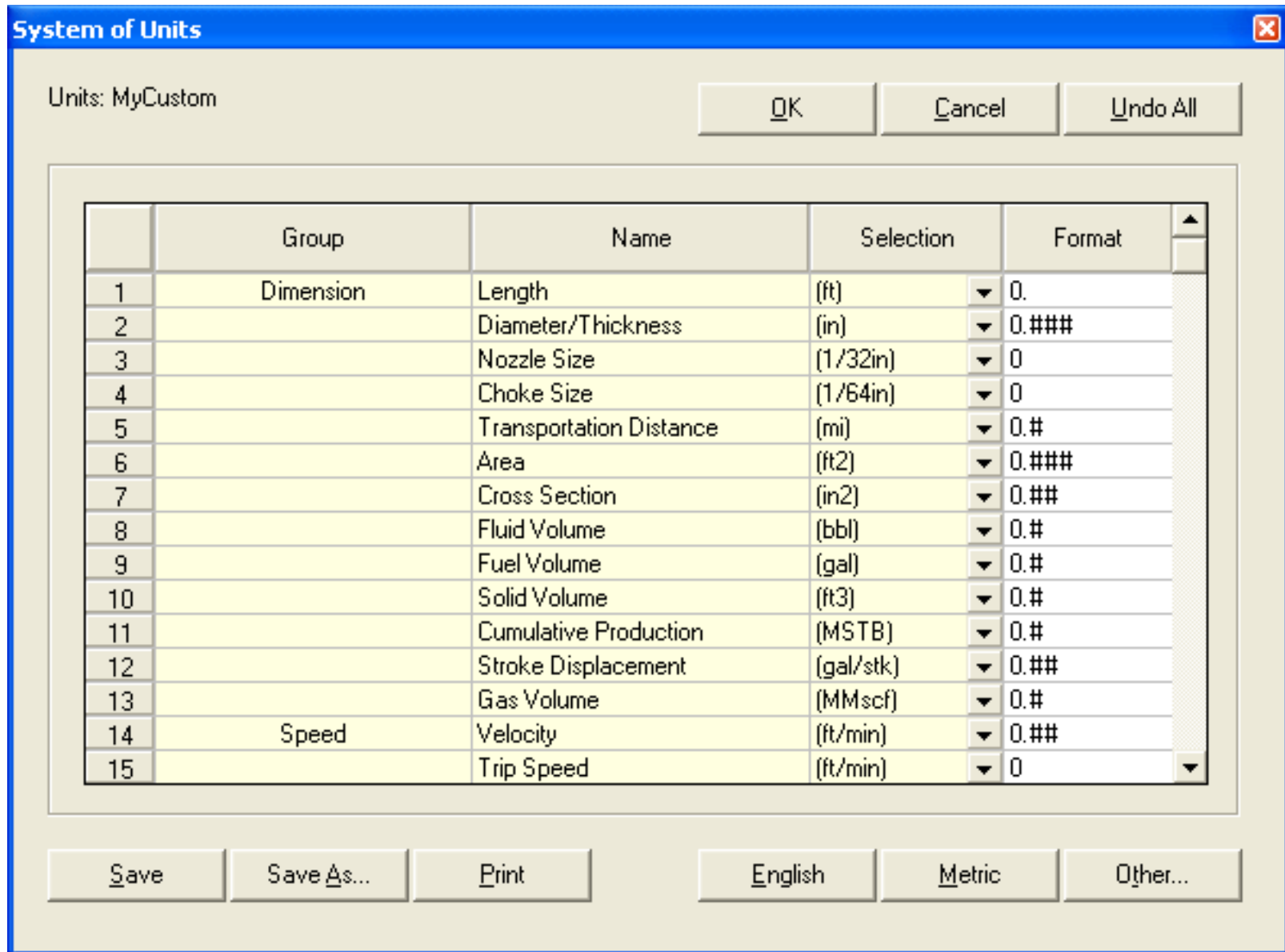
GTEMP

The complete data matrix of temperature with depth, radius and time is shown in a **3D Temperature Distribution**. You can rotate the graph in 3D space to obtain the best view of the results.



GTEMP

In the **Pressure and Temperature at Fixed Depth** window, a constant depth and specific time interval of interest are used to calculate a detailed temperature/time profile.



Units for input and output displays are easy to select and customize. Choose between the default metric or English systems, or a custom combination of units (for example, depth in meters, hole size in inches). Custom systems are saved and automatically recalled in future sessions.

**Help for GTEMP**

File Edit Bookmark Options Help

Back Print

Introduction

- Background
- Features
- Quick Tour
- Uninstalling GTEMP

Theoretical Basis

- Theoretical Background**
- Liquid Flow
- Gas Circulation
- Two-Phase Steam
- Surface Mud Tank

Input

Output

- Main Output Window
- Thermal Analysis Window
- P&T at Fixed Time Window
- 3D Temperature Distribution
- P&T at Fixed Depth Window

MTI Software

### General Theoretical Background

#### Wellbore Description

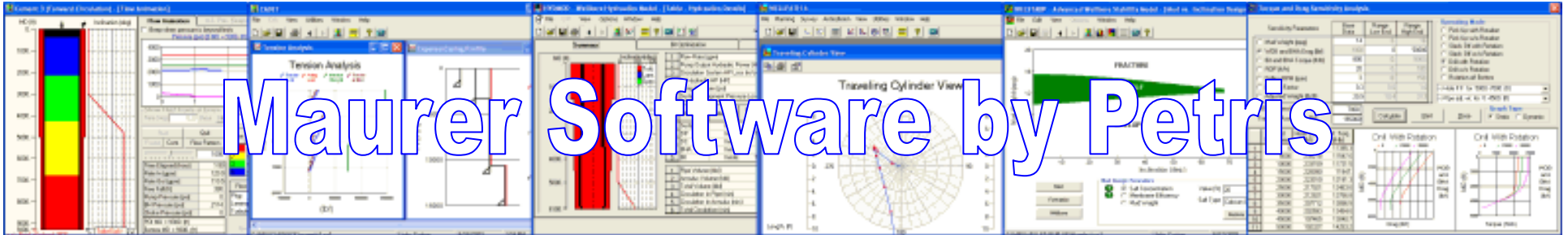
Two basic wellbore fluid flow models are included in **GTEMP**: 1) a well completion designed for production or injection (left); and 2) a well completion in which fluid is circulated (right). In the figure, the tube in the center is the production tubing or drill pipe; the casings outward in order are: production casing, intermediate casing, surface casing, conductor pipe, and finally borehole. Outside the borehole is rock formation.

#### Numerical Grid

Three temperatures are computed in the wellbore at each depth (see below). Radial

**GTEMP**

A comprehensive **On-Line Help System** is provided. Tips on program operation, program structure, and basic theoretical background are immediately available at the click of a button.



# Thanks for your interest in **GTEMP**

*For more information on Maurer Software by Petris,  
email:*

**sales@petris.com**

*or visit us on the web at*  
**www.petris.com**

**PETRIS**