A note of caution: Our software is frequently upgraded and newer versions of the software sometimes function differently and have increased but different functionality, so please keep your pen or pencil handy and take notes as we go through these exercises.
Ray-trace modeling is undertaken using GeoGraphix > Struct > Model Entry

Start > All Programs >
Select GeoGraphix from the list then click
Modeling >
GeoGraphix Seismic Modeling
The following selection window will come up.
Click on LogM Seismic Modeling

In the LogM folder click on the Structural Model Entry program

Select StandAlone usage
• When the *Structural Modeling* window opens up, bring up a new model window by clicking on the *new structural model* button at far left (see below).

• A window will pop-down. Use *Syncline* as the filename for this first model. The title is arbitrary but put something in there to remind you what it is you’re trying to do.

• Set end X distance to 20000 feet.

• Set number of Horizontal samples = 200

• Set Start Depth = 0

• Set End Depth = 6000

• Set the vertical line labeling to 5000 feet (follow in class demo and see diagram on the following page. Note that Vertical Line labeling actually marks distances along the horizontal or x-axis.

• Set horizontal line labeling (see diagram on the following page). The "horizontal labels" mark depths.

In the horizontal grid scale box set the major tic interval to 1000 feet, the minor tic interval to 500 and set the tick length to 0.2 for the major and 0.1 for the minor tic marks. Then OK to complete.
Set the labeling parameters for the vertical grid lines (figure above).

Set the labeling parameters for the horizontal grid lines (figure above).

When done, click OK on the model parameters window and exit (refer to model parameters window on page 1).

A model window will open. Go over to **Edit** and click on **Input Horizon** (see below).

Enter points defining the syncline (see next page) from left to right. Just move the mouse arrow to the desired point and click the left mouse button to enter them.

Follow in-class demonstration.
Model Window

In the define horizon window check **Reflecting** and **Curved** (see right).
Use the mouse and begin clicking points across the profile to define a very tight syncline. Note that after you have completed digitizing points across the profile, you can **Edit Select Horizon** and adjust the locations of individual points to obtain a smoother looking profile.

The first horizon should look similar to that shown below.

Once you are satisfied with the shape of your syncline enter a flat horizon across the base of the syncline at a depth of approximately 5500 feet.

Clicking on the **Tie Horizon/Channel/Fault** button is an easy way to finalize horizon entry.
Right clicking on the finished model will bring up a Define Body window. From there you can specify interval velocity and density, as well as a display pattern (see below).

Right click on the upper layer. Define body properties then right click on the next layer. Define its properties and so on till all the layers in your model are specified.

Velocities to be used in this model are specified below.
Follow along in class as we do this for each layer. Suggested interval velocities are tabulated below. To enhance the effect we want to produce in this model use a relatively low velocity in the upper layer.

<table>
<thead>
<tr>
<th>Layer/parameter</th>
<th>velocity</th>
<th>density</th>
</tr>
</thead>
<tbody>
<tr>
<td>Layer 1</td>
<td>5000</td>
<td>Take the default</td>
</tr>
<tr>
<td>Layer 2</td>
<td>10000</td>
<td>&quot;&quot;</td>
</tr>
<tr>
<td>Layer 3</td>
<td>15000</td>
<td>&quot;&quot;</td>
</tr>
</tbody>
</table>

The completed model will appear on the screen similar to that shown below - but in color.
Next - Click on the *synthetics* button (see below) then on *normal incidence* (remember a coincident source receiver recording yields a normal incidence raypath).

Fill out the parameter window as shown on the next page.

You will need to supply the name (Syncline). Traces per inch (use 25 for starters), inches per (second) (use 3), Number of traces (100) and Sample rate (4 milliseconds). Don’t generate infill traces, and take the default wavelet (remember what that is?). Now click generate trace – and wait. A window will pop up indicating that ray-tracing is taking place. After a few moments two plots will appear.
Normal incidence ray-trace parameter window.

After a few moments, the plots shown on the next page will appear on your screen. They appear in a separate Model Viewer window.

The “wiggly-trace” plot (right) will show you what your seismic data would look like over a subsurface consisting of the syncline you entered in the preceding depth/velocity model.

Maximize the time or depth (ray trace plot) by clicking on the plot so that the blue bar across the top lights up and then click on the “Not 1:1” button (the one with the X through it).
Click on the square in the upper right corner of individual display windows to obtain a full screen view of the model or time-response.

**Viewing Ray Paths**

Viewing ray-paths requires tinkering with the Plot Setup parameters. Bring the model window into a full screen view, and then click on the **Plot Setup** icon (second from right end). You’ll get the following window.
In this window, click on **Data Area** to bring up the following window.
Remove the check mark from the **Plot Color Fill** box, and make sure the **Ray Trace** box is checked. Then click on the **Select Bodies** button which will bring up the following window.

In the above window, you can select the horizons you want to see rays for. Check all horizon boxes so that we can view ray paths to all horizons. Then OK yourself out of these windows to view the ray paths as shown below.

Now return to the ray trace check boxes and select only rays to horizon 3.
That will yield the following result.

Click on the print icon and select a 6X6 plot area for printing. You may want to try this later when everyone is unlikely to be doing it at once. The plotting option is hard to control, but selection of a relatively small area should give you a 1-page plot on an 8and 1/2 inch by 11 inch scale.

Instead of plotting right now, experiment with the zoom in and out buttons.

Close the Model Viewer and save your model.
Once you have created a model and saved it, you can view the results of your model efforts through the Struct Model Viewer. Go to the Start Programs buttons and work your way over to the model viewer (see below).
Click on the open file folder at far left (top) and select your **Syncline** model. Select **Normal Ray** and **Normal Trace** and then click **OK**.

![Image of Select Structural Cross Section Files dialog box]

You will have to work with the **plot setup** dialog box to get your raypath plot.

To finish up today’s lab we’ll spend some time formatting model labels.
Geology 554
Computer Lab Exercise - Pitfalls I

Geometrical and Velocity Pitfall across a Syncline

- Make plots (screen capture will be best) of the ray path drawing (Ray - Normal Incidence plot) and the synthetic seismic display (Trace - Normal Incidence plot). Use Figure numbers for reference in text and figure captions to identify what you are showing.

- Explain what you see in both plots. Where is the buried focus in the ray-trace plot (recall lecture discussion)? Label the ray-trace diagram. Note the velocities you used in your model.

- Label features on the time plot (synthetic seismogram - Trace - Normal Incidence Plot) and explain why you see the features that appear in the synthetic.

- How do you explain the appearance of the deepest reflector in the reflection travel time plot? Remember that this is actually a flat layer!

- Hand in your comments and illustrations next Tuesday (Oct. 25).

See the following for suggestions on how to illustrate your reports.
This is just a reminder of procedures used to incorporate screen graphics into your word document to illustrate your lab reports as well as for writing assignments in other classes.

One way to get the screen image into your word file is to use the use the Print Screen button. Let's say that you wanted to illustrate the ray paths generated in today's modeling exercise. The results shown below appear in the interpret window after the F-key (forward computation) is depressed. To copy the image from the screen, simply depress the Print Screen button. Nest open up a text box in your word file, and use the Edit Paste option in Word to place the model into the text box. Placing the image in a text box allows you to adjust the position of the image within your document. The Print-Screen method gives you the entire screen (see below).

Opening a text box is illustrated below. To open up a text box click on the button illustrated below, then click and drag open a box. Then put the mouse arrow inside the text box, click once, and then go to the Edit option across the top menu bar and select paste or use the key

Click in here in side the text box and then simultaneously depress the Crtl button and the V button to paste your image in the text box.

18
sequence **Ctrl** to paste the image into the text box. Give it a try.

The icon at left is the Text Box icon

If you copy a window that has more than one plot in it (see below) you can edit it to show only the plot of interest

Use picture-editing tools to trim the image and also adjust contrast and brightness. Simply right-click in the area of the windows menu bar and select **Picture**.
The picture menu bar is shown below.

With minor editing we can obtain the following plot of the time section.
What is this curious looking feature?

Use screen captures to illustrate your lab reports, term reports etc.

If you have any questions - Please ask!