GP40 – The Earth From Space - Spring 2003 **Handout 5**
Lab exercise #1

Today's exercise involves examining and interpreting several remote sensing images of the Earth's surface. Specifically, we are going to look at images of our own local neighborhood. These data were acquired by the Landsat Thematic Mapper satellite. Follow each of the steps below in order to analyze the images. Where noted, record items for your writeup. The writeups may be fairly informal, but be sure to include all necessary information.

1. Turn on the computer monitor and log in using the class account 'gp40' and password as given in class.

2. You will be using a program called "Scion Image" and viewing some data files that you will store on the computer's desktop. Open a web browser, and go to the class web page at http://www.stanford.edu/class/geophys40.

3. First, you will need to load the Image program. Under the Software tab on the class page, download the file InstallImage.exe to the desktop. Execute this file by double clicking and install it on the desktop.

4. Next, select the Homework tab on the class web page. Download the file under "Zip file for Lab Exercise 1'. Unzip this file by double clicking. If your computer does not have WinZip already installed to unzip the exercise folder, you can download it from the Software tab and use this version of the program to unzip the exercise.

5. Start the Scion Imageprogram.

6. When the program starts up, open the "file" menu, and select "import."

7. Navigate the menu to find the desktop, and double click to select it.

8. Locate the Ex. 1 directory on the desktop, and double click to open it.

9. Open the Ex. 1 folder to see files inside called stanford.rgb.tiff, stanford.cir.tiff, and sf6by6.cir.tiff. On some machines, Windows does not show the last suffix of a filename and the files are called stanford.rgb, etc. Each of these images is 1024 by 1024 pixels in size. Each pixel represents 28.5 x 28.5 meters on the ground.

10. Find the Ex. 1 directory in the pulldown menu in Image and double click on stanford.rgb.tiff (or stanford.rgb).

11. Click OK in the dialogue box that appears.

12. Use the hand tool to move the picture around.

13. Find each of the following in the image:

The Dumbarton Bridge
Moffett Field runways
SLAC
Highway 280
Stanford
Stanford Stadium
Your house/dorm

Next, we will make some distance measurements. We can use the Pythagorean theorem to get the length of diagonal lines:

$$\text{distance} = \sqrt{x^2 + y^2}$$

where distance is the diagonal distance, and x and y are the horizontal and vertical lengths of a line.

14. In Image, select the tool that looks like a dotted outline box from the tool window.

15. Click on the "info" window to bring it to the foreground. If necessary, move the window so that you can see it and the image simultaneously.

16. Now, as you move the cursor around in the image window the info window gives you the location in pixels and inches.

17. What is the location of the field in Stanford Stadium in pixels ?

18. Find the Dish, one of three dots on the hill bewteen Stanford and Highway 280. What is its location in pixels ?

19. Calculate the distance between the two locations in pixels in x and y, that is horizontally and vertically. With these two number, estimate the distance from one location to the other in pixels ?

20. Since the pixel spacing in this image is 28.5 meters, multiply the value in pixels by 28.5 to get the distance in meters.

Now that we know how to calculate distances, we'll let the computer do the work. We have to set the measurement scale so the computer knows the pixel spacing.

21. Select the item "Set Scale" from the "Analyze" menu.

22. On the "Units" submenu, select meters.

23. Enter 1.0 for measured distance, and 28.5 for known distance. The scale should read "Scale 0.035 pixels per meter".

24. Click OK.

Now distances show in the info window in meters.

25. Next, move the image window to the right by placing the mouse in the top portion of the window and dragging. Move it just enough that you can read the values in the info window easily.

26. Select the line tool (looks like a slanted line) from the tool window.

27. Place the cursor anywhere in the image. Holding the mouse button down, move the cursor, drawing a line from where you started to where you end up. Keeping the mouse button depressed at the end of the line allows you to read the line length directly from the info window. Use this method to again measure the distance from the stadium to the dish.

28. How long is SLAC's accelerator ?

29. How long is the longest runway at Moffett Field ? Use the hand tool to reposition the image, if necessary.

30. What is the length of the Dumbarton bridge from the edges of the Bay proper ?

31. Finally, open the second image of the area called "stanford.cir.tiff" through the import menu as before. Examine the colors in this image. Using your knowledge of the local geography, which color corresponds most closely to areas covered by vegetation ? Identify areas of dense vegetation growth. This coloring follows from displaying the reflectance of the ground at infrared wavelengths as red.

Let's now look at a larger scale image. Close the Stanford image by clicking in the small box at the upper right (on some machines, upper left) of the image window.

Open the sf6by6cir.tiff image through the import menu as before.

32. Reset the scale by again opening "set scale" under "Analyze." Set units to meters, measured distance to 1 pixel, and known distance to 171 meters. The scale should read 0.005848 pixels per meter. Click OK.

33. Find the approximate location of Stanford on this image.

34. Find the approximate location of the San Andreas fault by imagining a line that goes through the Crystal Springs reservoir along highway 280. Note how close this line runs by Stanford.

35. Examine the image to find the areas of densest vegetation (red color). What geographical areas are most heavily vegetated ?

36. About how far is it from Santa Cruz to San Francisco, as the crow flies ?

37. Would you expect there to be a road that runs along a straight line from Santa Cruz to San Francisco ? Could one be built easily ?