COMP5514 Computer Graphics in C/C++

Lab 03

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Contents: Pixels in The Frame Buffer

PART A: PIXELS

- Pixels
- Bitmaps
- Frame Buffers

PART B: LIBRARIES

- GL Library
- GLU Library
- GLUT Library

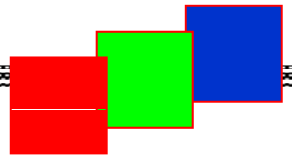
PART C: EXAMPLES

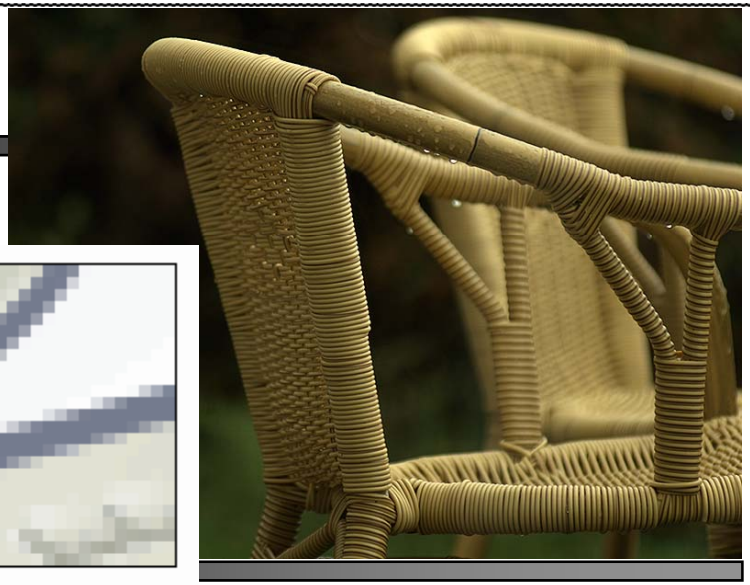
- Basic OpenGL program

Objectives: Frame Buffers

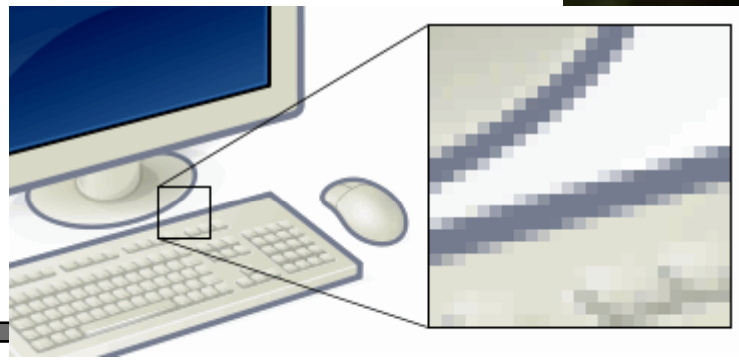
- Pixel Attributes
- Bitmaps
- Frame Buffer
- Depth Buffer
- OpenGL Functions

Pixels





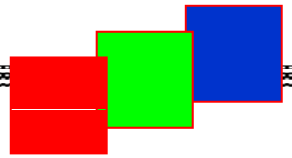
- **Pixel = PICture ELement**
  - From wiki
  - Magnify
  - Sampling



- **Dead pixel test:** I See Dead Pixels
  - how to find dead pixels on an LCD
  - Reference: **http://www.gdargaud.net/Hack/DeadPixels.html**

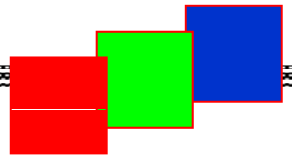
- **Example:** lab03.zip

Pixels (2)



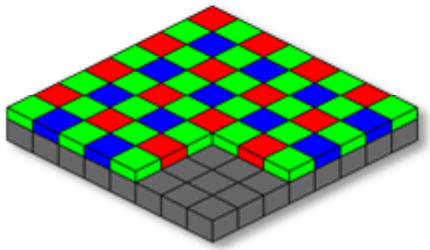
- **Pixel = PICture ELement**
  - A pixel is not only a little square
  - A picture can be constructed using:
    - dots, lines, smooth filters

Pixels (3)

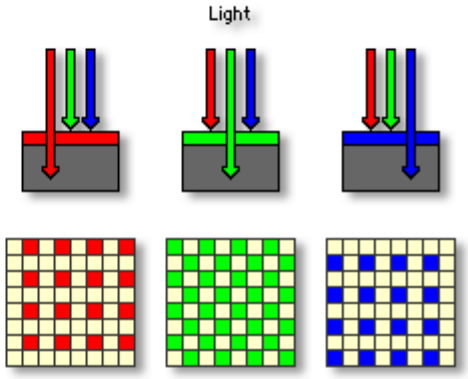


- **Screen Space:**
  - 1.0 x 1.0 screen area
  - Coordinates: “window” or “screen”
  - Coordinate type: integer

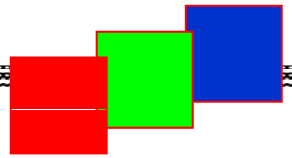
- **Color Filters:**



Color Filter Array Sensor



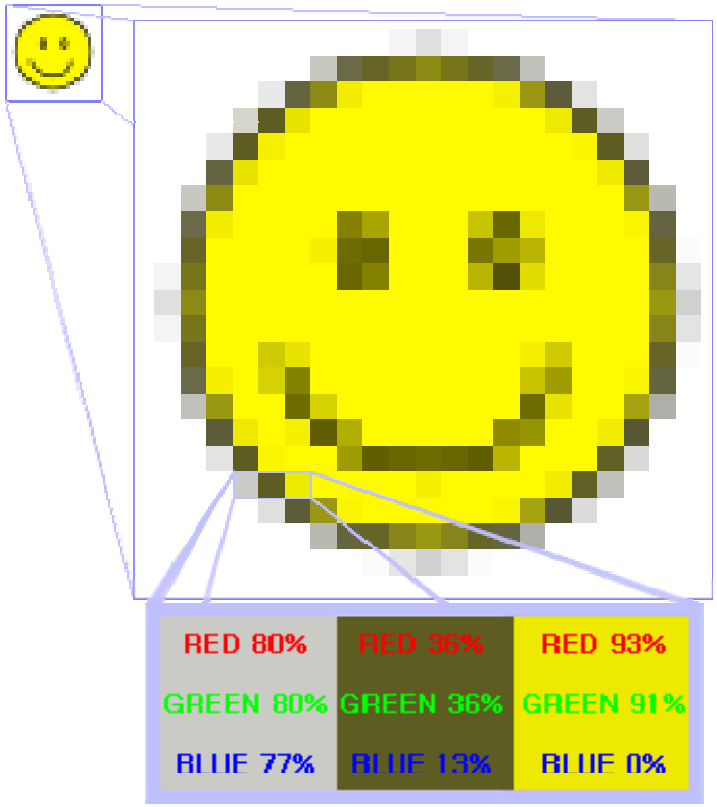
Bitmaps



- **Bitmap = Pixmap = map of bits**
  - organization of memory used to store an image
- **Raster images = bitmaps for the entire screen**
- **Image pixels are generally stored with a color depth of: 1, 4, 8, 16, 24 or 32.**
- **Images of 8 bit color are INDEXED.**

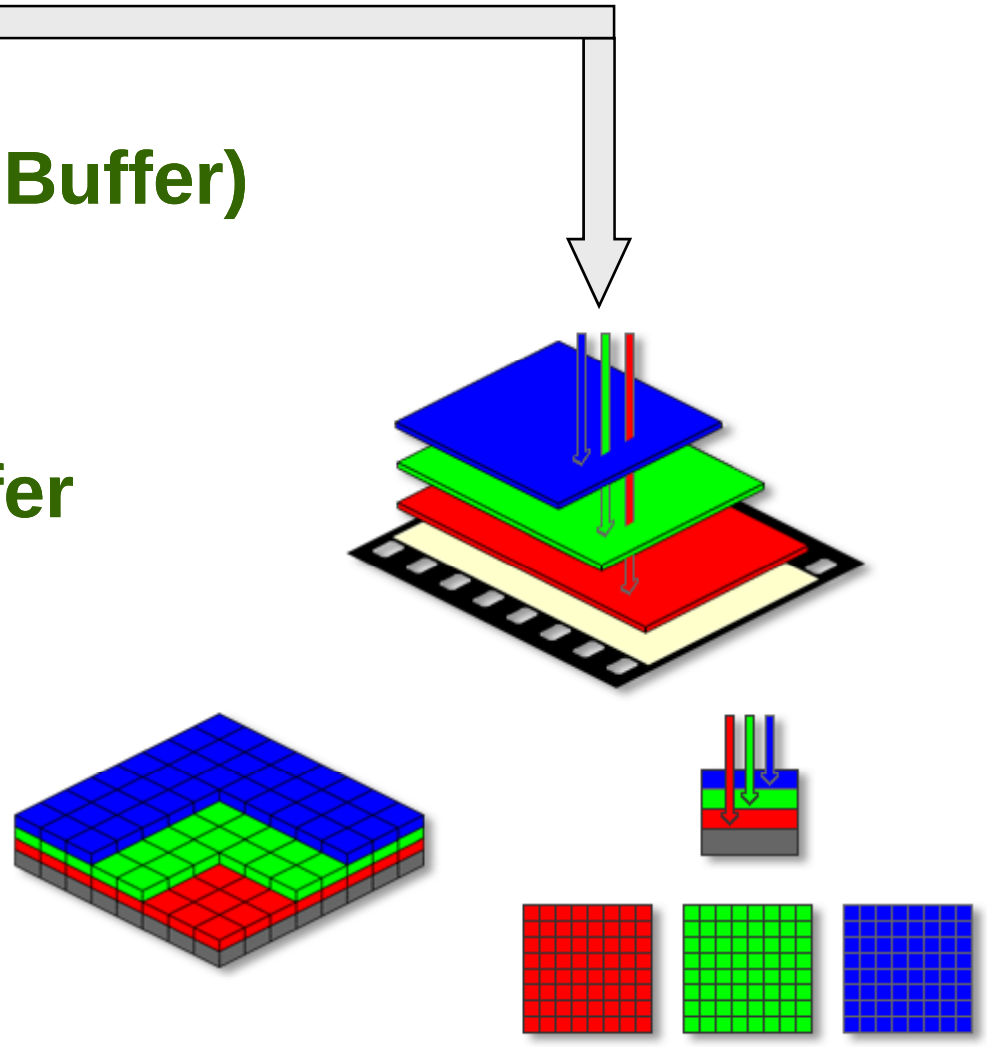
Bitmap Example

- **The small smiley face as an RGB bitmap image and the zoomed version (ref. wiki)**



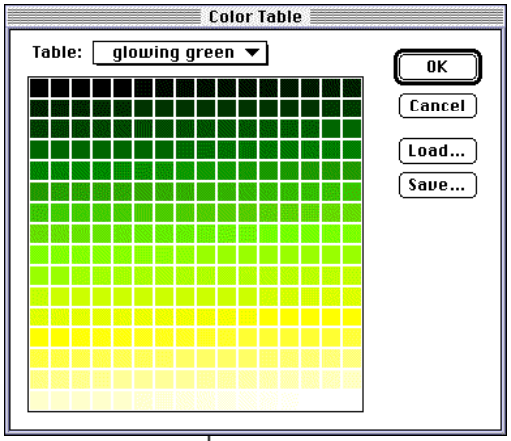
Buffers for Image Rendering

- Color Buffer(s)
- Depth Buffer (or Z-Buffer)
- Stencil Buffer
- Accumulation Buffer

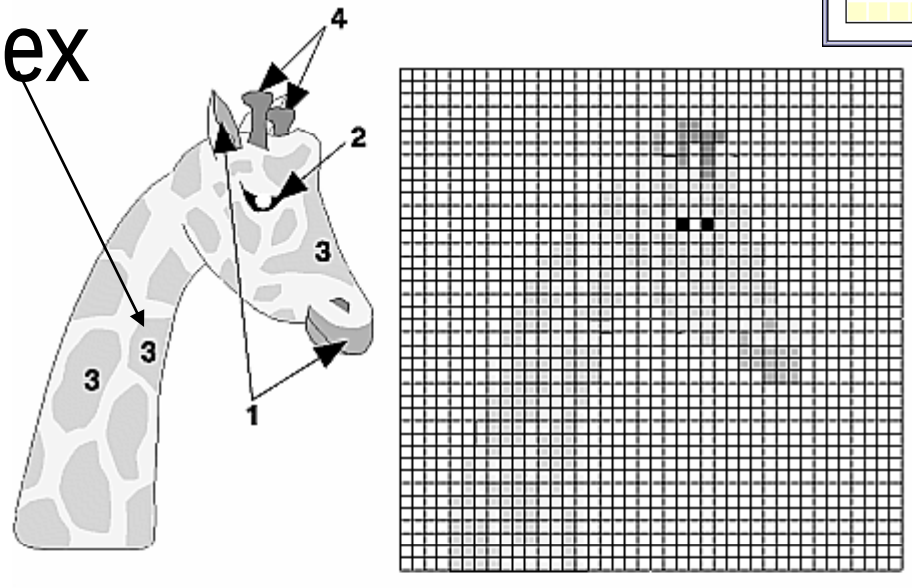


Color Buffer = Frame Buffer

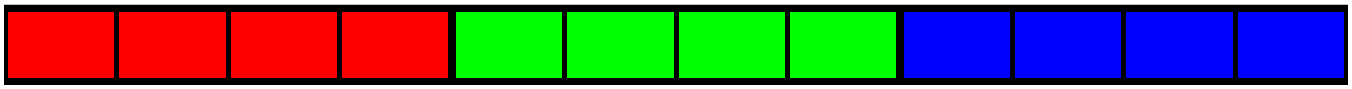
- **Immediate Mode = R G B**
- **Color Index Mode**
  - example: 8 bit color in windows



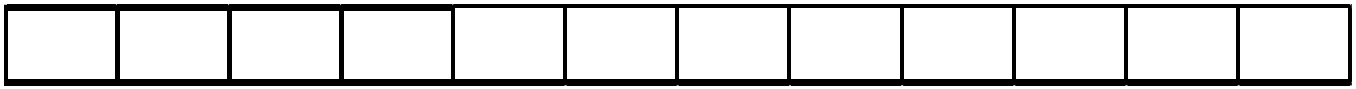
color index



RGB value vs Color-index

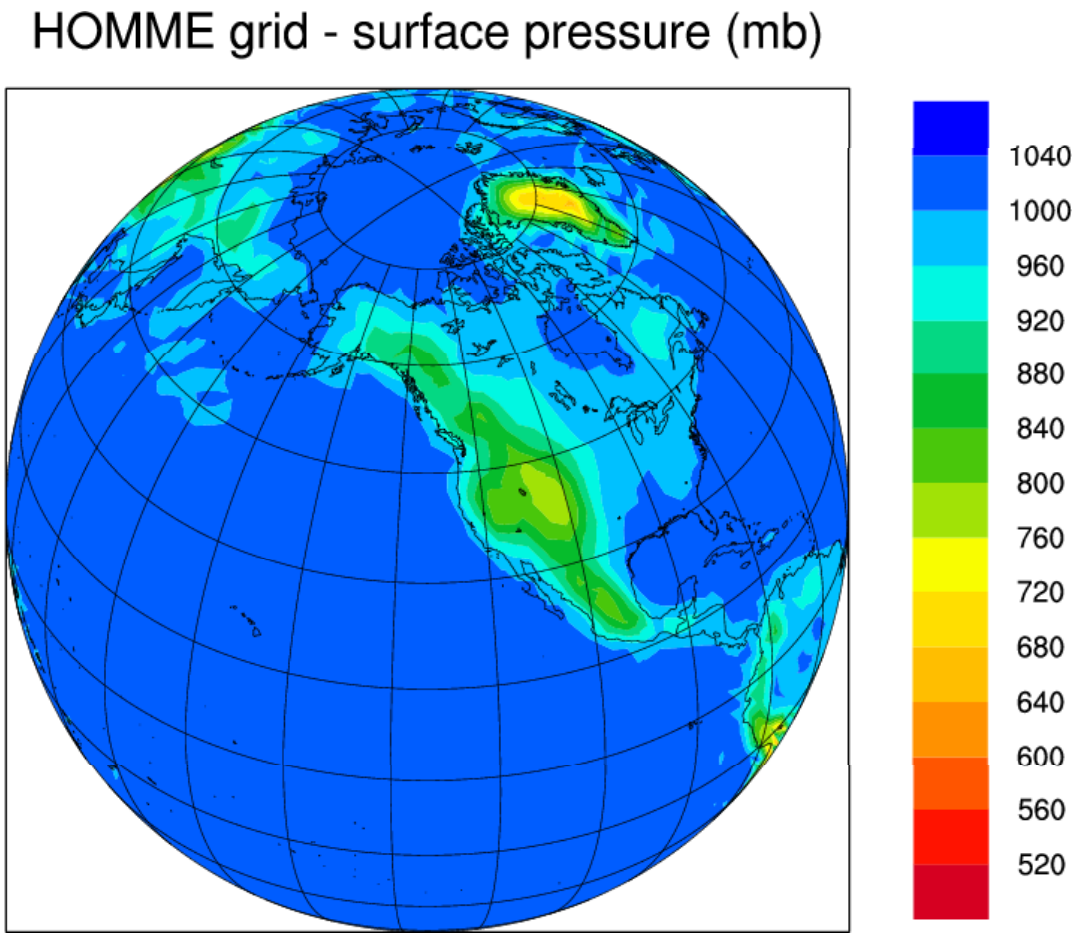


3 intensity values



1 color index for color look-up in color map

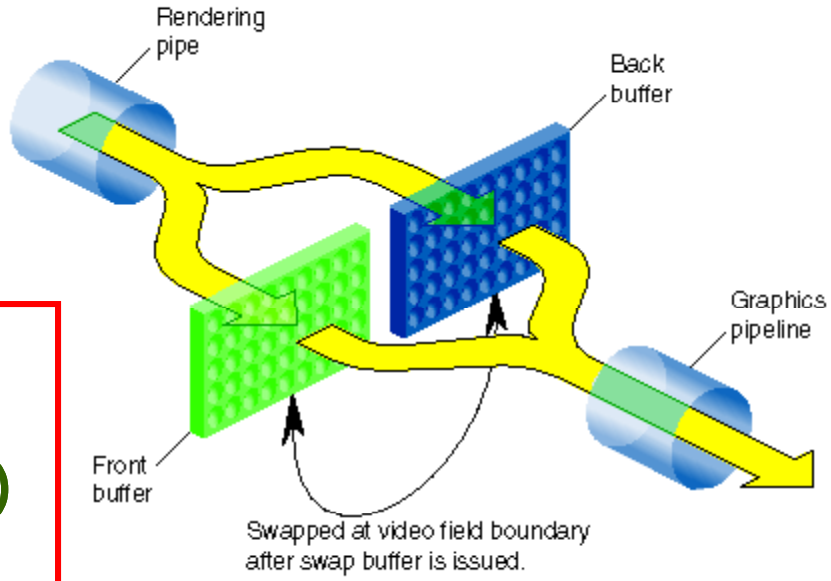
Use of Color-Index Mode



Double Buffers

- Multiple Color Buffers
- Used for animation
- Switching between buffers
- Double Buffer vs

  Single Buffer Mode



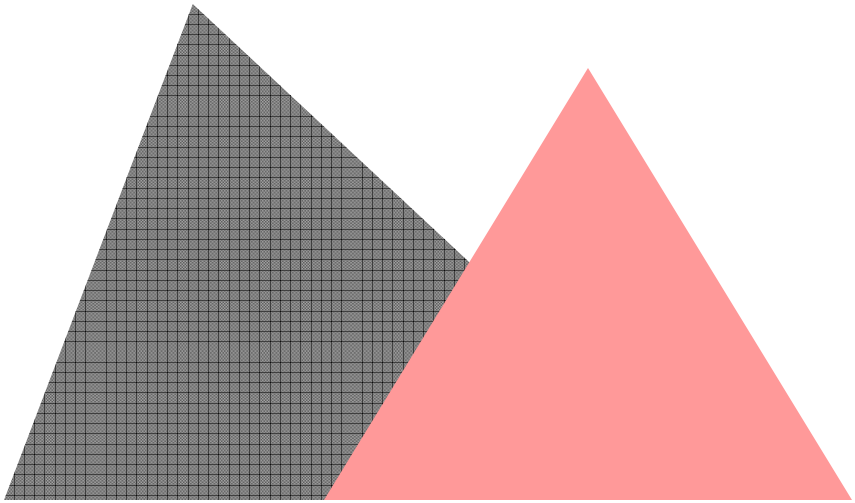
In OpenGL:

glutInitDisplayMode(GLUT_DOUBLE)

glutSwapBuffers()

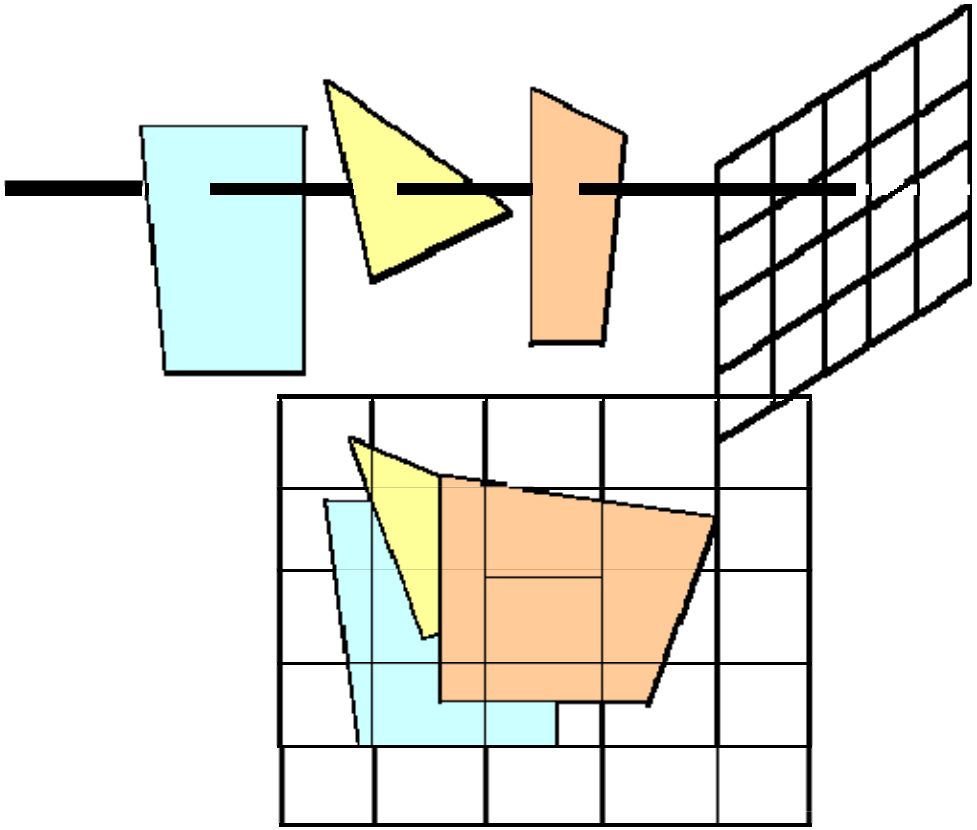
Depth Buffer (Z buffer)

- Stores a depth value
- Hidden-surface removal



Depth Buffer

- Used to render objects in 3D at different depth



How to draw pixels in OpenGL

- **OpenGL Functions:**
  - glReadPixels()
  - glDrawPixels()
  - glCopyPixels()
  - glBitmap()

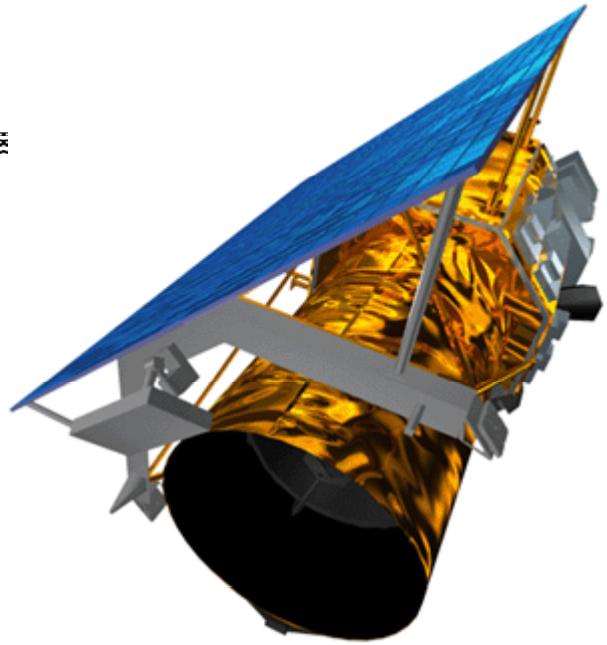
- **Positioning for raster drawing:**
  - glRasterPos*()
  - glGet*()

References:

http://www.eecs.tulane.edu/www/graphics/doc/OpenGL-Man-Pages/ /opengl_index_alpha.html

Try things out. . .

- **Example:** lab03.zip



The End