overview of the data if the loaded imagery is larger than this size. The window dimensions will vary to maintain a 1:1 aspect ratio.

The SHOW IMAGERY option shows a nadir view of the image data. This is shown in color or gray scale depending on the type of data loaded.

The SHOW ELEVATION option shows a nadir view of the elevation data. This is always shown in gray scale.

The CLOSE NADIR option closes the nadir view.

In the Nadir window, the mouse buttons can be used to change position and toggle between imagery and elevation views. The following button assignments are made:

left: *(move)* changes the current viewing position.

right: *(image/elev)* toggles between the image and elevation views.

3.19 Memory Usage and Speed Hints

FLY! is a memory intensive application. The following chart shows the RAM memory required for various input data sizes:

```
1024 x 1024      11 MBytes
1536 x 1536      20 MBytes
2048 x 2048      29 MBytes
4096 x 4096     100 MBytes
```

Add 5 to 8 Mbytes on top of this for the operating system and Motif/OpenWindows user interface.

For example, if your workstation has 32 Mbytes of RAM, a 1536 x 1536 database should run well. A 2048 x 2048 database, which would also work, may have very poor performance since RAM memory would be overloaded and the workstation would spend most of its time swapping memory to and from disk.

To achieve maximum performance, it is best not to run any other applications while FLY! is active.

3.16 3-D Control Panel

The 3-D control panel is activated via the 3-D option in the View topic in the MenuBar in the FLY! main window. It allows the user to modify the parameters which control 3-D viewing. This popup is only available if 3-D viewing has been activated.

The BASE LINE field specifies how far apart the left/right images are. Values can be from 1 to 30 pixels. The default is 4 pixels.

The FOCAL LENGTH field specifies the focusing point in pixels. Values can vary from 32 to 512 pixels. The default is 64 pixels.

Altering these values can enhance the 3-D effect (and possibly give you a headache).

The APPLY button forces the new values to be accepted. The scene is rerendered to show the results. The popup remains open.

The DEFAULT button forces the all the fields back to the default values. The scene is rerendered to show the results. The popup remains open.

The CLOSE button closes the popup. Any modified values are lost unless they were accepted using the APPLY button.

3.17 Rendering Frame Size Panel

This Rendering Frame Size panel is activated via the RENDER SIZE option in the View topic from the MenuBar in the FLY! main window. It allows the user to specify the size of the rendering window in pixels and lines. Please note that this window can also be resized by dragging out one of its corners.

The X FRAME SIZE field specifies the X size for the frame in pixels.

The Y FRAME SIZE field specifies the Y size for the frame in lines.

The APPLY button forces the new values to be accepted and the frame to be rendered again.

The DEFAULT button sets the rendering size to the default values (typically 512 pixels by 350 lines). The APPLY button must be used to actually accept the values.

The CLOSE button closes the popup.

Common sizes for rendered windows are 320 by 240 or 640 by 480. The minimum is 64 by 64. The maximum is 1024 by 768.

3.18 Nadir Views

The Nadir pulldown menu in the MenuBar gives options for a window showing the image or elevation data from a nadir view (i.e., an overview of the data looking straight down). This is useful in showing the actual database which is loaded. This window is approximately 512 pixels by 512 lines in size and shows a decimated

3.14 Perspective Control Panel

This popup is activated via the PERSPECTIVE option in the View topic in the MenuBar in the FLY! main window. It allows the user to modify the parameters which control aspects of the rendered image.

The HEIGHT MAGNIFICATION field allows the effects of elevation to be exaggerated. The default setting is 1.0. Values can vary from 0 to 3.0. A value of 0 has the effect of removing elevation.

The HORIZON TILT field allows the horizon position to be varied in degrees. Values can be varied from 0 to 30. The default is 20 degrees.

The PIXEL ZOOM field control the size of the foreground pixels at low elevations. It can vary from 1 to 100 percent. The default is 100 percent. The maximum size of foreground pixels is automatically determined by FLY! and is not under user control.

The VIEW CONE field controls the view cone used in the render image. This can vary between 30 and 120 degrees. The default is 60 degrees. Larger values for view cone tend to exaggerate the effects of perspective.

The APPLY button forces the new values to be accepted. The scene is rerendered to show the results. The popup remains open.

The DEFAULT button forces all the fields back to the default values. The scene is rerendered to show the results. The popup remains open.

The CLOSE button closes the popup. Any modified values are lost unless they were accepted using the APPLY button.

3.15 3-D Images

FLY! has the ability to render frames which give an appearance of true 3-D depth. This option can only be used when a grayscale (black and white) image is loaded.

The 3-D effect is produced by generating slightly different left and right views, for the left and the right eyes. The left view is rendered in blue, the right view is rendered in red, both views are merged. The user must wear anaglyph glasses (i.e. glasses with a blue lense for the left eye, red for right) when viewing the merged image. The blue lense filters the left image to the left eye and the red the right image to the right eye. The brain then integrates the resulting two images to a 3-D. Better 3-D effect can be generated using polarised light techniques, shuttered glasses or virtual reality goggles; however, these require the use of expensive equipment.

3-D viewing is turned on/off via the RENDER NORMAL/3-D option in the Options topic in the MenuBar in the FLY! main window.

Hint: Try setting entire window environment to gray (if possible) to reduce extraneous colors, or mask out the rest of the screen with pieces of paper, so only the 3-D image and the interface are visible. Darkening the room also helps.

3.11 Record and Playback

The Record and Playback buttons are located on the main window of FLY!. These allow the user to record and playback flights in a manner similar to recording and playing on a VCR.

When the RECORD button is pushed FLY! saves all the viewing information used to generate the scenes as they are rendered. (Please note, only the information needed to reconstruct a rendered scene is saved, not the actual scene itself). Once a number of scenes (or frames) have been saved they can be played back. The following buttons can be used:

```
<<    Fast Rewind
||    Pause
>     Play
>>    Fast Forward
```

3.12 Playback Files

Playback files are used with the record/playback buttons in the FLY! Main Window. A playback file is the saved contents of a recording. Loading a playback file puts it back into the recording memory where it can be replayed (see the section on Record/Playback).

Each line in a playback file contains the general information required to generate a single frame in the recorded flight. The contents of each line are:

Xpos, Ypos, elevation, speed, movedirection, lookdirection

The numbers are in text form so this file can be edited using any text editor. There are a maximum of 9999 lines. Comments can be inserted in the file using a ! character in the first column.

It is up to the user to ensure that a loaded playback file is relevant to the currently loaded image. FLY! makes no restrictions so it is possible to load a playback file meant for completely different image.

3.13 Position/Speed/Direction Control Panel

This popup is activated via the POSITION option in the View topic in the MenuBar in the FLY! main window. It allows the user to explicitly enter the X,Y and Elevation (Z) for viewing position, as well as the speed and movement direction. Typically this is done roughly using the FLY! main window. The popup is useful if exact positioning is required.

The APPLY button forces the new values to be accepted. The scene is rerendered to show the results. The popup remains open.

The CLOSE button closes the popup. Any modified values are lost unless they were accepted using the APPLY button.

If the file contains a single channel then it is assumed to be black and white. All color data must be 8 bit.

The ENHANCEMENT radio buttons allow the user to apply a simple enhancement to the data as it is loaded. This can improve the appearance of the rendered images, especially if the original data is dark. The following enhancements are available: NONE, no enhancement; LINEAR applies a linear stretch between minimum and maximum gray level values; ROOT applies a square root stretch between minimum and maximum values; EQUAL applies a histogram equalization enhancement.

The ELEVATION FILE field specifies the name of the file containing the single channel of elevation data. The Elevation file and color file must have the same dimensions. The data can be either 8 bit or 16 bit.

The ELEVATION STEP field specifies the height resolution of the elevation data, that is, what a change of one level in the data means. This value is specified in meters. A typical value is 1.0.

The ELEVATION OFFSET field specifies the elevation value in the data which represents 0 elevation (typically sea level). This is required to properly report viewing positions. For 16 bit signed data this value is usually 0; for 8 bit and unsigned 16 bit data this is usually some other value.

The PIXEL SIZE field specified the size of a single pixel on the ground in meters. If this value is unspecified, or zero then the value stored in the header of the ERDAS file is used. Typical values are 30 for Landsat TM , 20 for Spot MLA, or 10 for Spot Panchromatic.

3.10 Saving Renderings to Disk

Rendered scenes can be saved to disk in a variety of file formats: PCIDSK, TIFF, RAW and ERDAS. Once on disk, they can be used as input to other software packages, typically to be printed or distributed to other computer systems. The popups for this action are activated by selecting the appropriate save option in the FILE topic from the MenuBar in the FLY! Main Window.

Regardless of the output format selected, the following actions are taken. If a file name already exists, the user will be asked if it should be overwritten. Color renderings are always saved in 24 bit RGB mode (3 channels of 8 bit), even if the display hardware in use is only 8 bit color. 3-D renderings are saved as a 24 bit RGB image with the green channel set to 0 (black). Black and white images are saved as a single 8 bit channel.

PCIDSK format files are created with full header and segment structure and can be used with EASI/PACE software.

RAW format files are saved with no formatting or header data. Color images are saved in pixel interleaved RGB format.

The IMAGE SIZE (X and Y) fields allow the user to specify the dimensions of the image to be loaded. If this is defaulted to 0, an attempt will be be made to automatically determine the dimensions based on overall file size and on the assumption that the file is square.

3.9.4 Loading Data from ISTAR Files

ISTAR is a French company making high quality DEMs and Orthoimages. ISTAR format files are typically raw format (i.e., no header information) with 10 cm elevation resolution and 10000 offset elevation.

Color and elevation data can be read from ISTAR format files. This is accessed using the Load from ISTAR file option in the FILE item in the Menu Bar in the FLY! Main Window.

The COLOR FILE field specifies the name of the file(s) which contain the color data.

The TYPE radio buttons specify the arrangement of data held in the file(s).

This can be :

- **r,g,b** if data is held in three separate files (in this case, the files must be named filename.r, filename.g, filename.b).
- **bw** if data is 8 bit gray scale.

The COLOR IMAGE SIZE (X and Y) fields allow the user to specify the dimensions of the image to be loaded. If this is defaulted to 0, an attempt will be be made to automatically determine the dimensions based on overall file size and on the assumption that the file is square.

The HEADER LENGTH field specifies the number of bytes of header data that should be skipped before starting to read data. Usually ISTAR format files have no header data so this value can be set to 0 for most cases.

The ENHANCEMENT radio buttons allow the user to apply a simple enhancement to the data as it is loaded. This can improve the appearance of the rendered images, especially if the original data is dark. The following enhancements are available: NONE, no enhancement; LINEAR applies a linear stretch between minimum and maximum gray level values; ROOT applies a square root stretch between minimum and maximum values; EQUAL applies a histogram equalization enhancement.

The ELEVATION FILE field specifies the name of the file which contain the elevation data.

NOTE: The DEM's size must be one half, in X and Y directions, of the color image size.

3.9.5 Loading Data from ERDAS Files

The COLOR FILE field specifies the name of the file containing the imagery data. If the file contains three channels, then they are assumed to be red, green and blue.

data.

The TYPE radio buttons specify the arrangement of data held in the file(s). This can be :

- **rgb** if data is 24 bit pixel interleaved.
- **argb** if data 24 bit rgb with a leading padding byte (32 bits total).
- **bw** if data is 8 bit gray scale.
- **r,g,b** if data is held in three separate files (in this case, the files must be named filename.r, filename.g, filename.b).

The HEADER LENGTH field specifies the number of bytes of header data that should be skipped before starting to read data. Usually this value is set to 0; however it can be useful if an unusual file format is being loaded and the header data length is known.

The ENHANCEMENT radio buttons allow the user to apply a simple enhancement to the data as it is loaded. This can improve the appearance of the rendered images, especially if the original data is dark. The following enhancements are available: NONE, no enhancement; LINEAR applies a linear stretch between minimum and maximum gray level values; ROOT applies a square root stretch between minimum and maximum values; EQUAL applies a histogram equalization enhancement.

The ELEVATION FILE field specifies the name of the file containing the elevation data.

The TYPE radio buttons specify the type of elevation data. These can be:

- **8 bit** for 8 bits unsigned (possible values from 0 to 255).
- **S 16 bit** for signed 16 bit (possible values from -32768 to 32767).
- **U 16 bit** for unsigned 16 bit (possible values from 0 to 65535).

The second HEADER LENGTH field specifies the number of bytes of header data that should be skipped before starting to read the elevation data. Usually this value is set to 0; however, it can be useful if an unusual file format is being loaded and the header data length is known.

The ELEVATION STEP field specifies the height resolution of the elevation data, that is, what a change of one level in the data means. This value is specified in meters. A typical value is 1.0.

The ELEVATION OFFSET field specifies the elevation value in the data which represents 0 elevation (typically sea level). This is required to properly report viewing positions. For 16 bit signed data this value is usually 0; for 8 bit and unsigned 16 bit data this is usually some other value.

The PIXEL SIZE field specified the size of a single pixel on the ground in meters. If this value is unspecified or zero then the value stored in the header of the PCIDSK file is used. Typical values are 30 for Landsat TM , 20 for Spot MLA, or 10 for Spot Panchromatic.

NONE, no enhancement; LINEAR applies a linear stretch between minimum and maximum gray level values; ROOT applies a square root stretch between minimum and maximum values; EQUAL applies a histogram equalization enhancement.

3.9.2 Loading Data from TIFF files

TIFF files are a common image interchange format and come in a variety of forms. FLY! will only read TIFF files containing 8 bit data.

The COLOR FILE field specifies the name of the file containing the imagery data. If the file contains three channels then they are assumed to be red, green and blue. If the file contains a single channel then it is assumed to be black and white.

The ENHANCEMENT radio buttons allow the user to apply a simple enhancement to the data as it is loaded. This can improve the appearance of the rendered images, especially if the original data is dark. The following enhancements are available: NONE, no enhancement; LINEAR applies a linear stretch between minimum and maximum gray level values; ROOT applies a square root stretch between minimum and maximum values; EQUAL applies a histogram equalization enhancement.

The ELEVATION FILE field specifies the name of the file containing the single channel of elevation data. The Elevation file and color file must have the same dimensions.

The ELEVATION STEP field specifies the height resolution of the elevation data, that is, what a change of one level in the data means. This value is specified in meters. A typical value is 1.0.

The ELEVATION OFFSET field specifies the elevation value in the data which represents 0 elevation (typically sea level). This is required to properly report viewing positions. For 16 bit signed data this value is usually 0; for 8 bit and unsigned 16 bit data this is usually some other value.

The PIXEL SIZE field specified the size of a single pixel on the ground in meters. If this value is unspecified or zero then the value stored in the header of the PCIDSK file is used. Typical values are 30 for Landsat TM , 20 for Spot MLA, or 10 for Spot Panchromatic.

3.9.3 Loading Data from RAW files

RAW format files are simple format files which are used by many image processing systems. Usually they are raw image/elevation data with no header or structural information.

Color and elevation data can be loaded from RAW format files. A RAW file is one which typically has no header or formatting information. Separate files are required for the color and elevation data; however, these files must be co-registered, that is, they must have same number of pixels in the X and Y directions. This option is accessed using the Load from RAW file option in the FILE item in the menu bar in the FLY! Main Window.

The COLOR FILE field specifies the name of the file(s) which contain the color

In the FLY! NADIR WINDOW the mouse buttons can be used to change position and toggle between imagery and elevation views. The following button assignments are made:

left: *(move)* changes the current viewing position.

right: *(image/elev)* toggles between the image and elevation views.

3.9 Loading Data

The File pulldown menu in the MenuBar gives options for loading data. Five data file formats are supported: PCIDSK, TIFF, RAW, ISTAR and ERDAS.

It is also possible to preload data when FLY! is first run by using command line options.

3.9.1 Loading Data from PCIDSK Files

The PCIDSK file format is used by EASI/PACE software from PCI Inc.

Color and elevation data can be read from PCIDSK format files. This is accessed using the FILE option in the Menu Bar in the FLY! Main Window.

All imagery and elevation data must be in the same file. The size of the database and the type of data channels is automatically determined from the PCIDSK header information on the file.

The COLOR CHANNELS field specifies the channels to be used for color. Specifying one channel indicates black and white imagery. Three channels are specified for color imagery: the first value is red; the second green; and the third, blue. All color channels must be 8 bit.

The ELEVATION CHANNEL field specifies the single channel to be used for elevation data. This can be 8 bit, 16 bit signed or 16 bit unsigned. Real data is not supported.

The ELEVATION STEP field specifies the height resolution of the elevation data, that is, what a change of one level in the data means. This value is specified in meters. A typical value is 1.0.

The ELEVATION OFFSET field specifies the elevation value in the data which represents 0 elevation (typically sea level). This is required to properly report viewing positions. For 16 bit signed data this value is usually 0; for 8 bit and unsigned 16 bit data this is usually some other value.

The PIXEL SIZE field specified the size of a single pixel on the ground in meters. If this value is unspecified or zero then the value stored in the header of the PCIDSK file is used. Typical values are 30 for Landsat TM or 10 for Spot Panchromatic.

The ENHANCEMENT radio buttons allow the user to apply a simple enhancement to the data as it is loaded. This can improve the appearance of the rendered images, especially if the original data is dark. The following enhancements are available:

a list of available topics. The last section contains the buttons: CLOSE, HELP and 'Save to File fly.help'.

To use the help system, select an entry from the topic list by clicking on it. The help text for this topic will show up in the text window. Use the scroll bars to scroll through help text and the list of topics.

The CLOSE button closes the help popup. The HELP button shows this text. The 'Save to File fly.help' dumps the text currently shown in the text window to the ascii text file **fly.help** on disk which can be printed.

3.8 Mouse Button Shortcuts

To make user interaction more natural and faster, the mouse buttons are assigned various meanings in some of the FLY! windows.

In the FLY! RENDERING WINDOW, the mouse buttons can be used to turn, pause/run, and change elevation quickly and naturally. The following button assignments are made:

left: *(turn)* changes the direction of viewing (and of movement). Position in the rendered image clicked on becomes new direction.

middle: *(run/pause)* toggles between pause (stop) and run (go).

right: *(elevation)* changes elevation proportional to the position of the mouse cursor. Clicking near the top of the window changes to a high elevation, near the bottom to a low elevation.

In the FLY! MAIN WINDOW, the position graphics area can be used to quickly move the viewing position. The following button assignments are made:

left: *(new position)* moves the viewing position to the position clicked on.

In the FLY! MAIN WINDOW, the direction graphics area can be used to change the viewing direction and movement direction. The following button assignments are made:

left: *(view/movement)* changes the direction of viewing and movement.

middle: *(view)* changes the direction of viewing, but not movement. This allows the user to look behind or to the side.

right: *(restore view)* makes the view direction the same as the movement direction.

-sp speed
gives initial speed in km/h. Default is 500 km/h.

-zo zoom
indicates percentage zoom foreground pixels. Default is 100.

-ht tilt
gives amount of tilt (position of horizon) in rendered frames. Value is in degrees. Default is 25.

-vc viewcone
gives cone of view (in degrees) for rendered frames. Range is 0 to 120. Default is 60.

-3d baseline focalpoint
forces the system to go into 3d mode. Values baseline and focal point are in pixels. Defaults are 4 and 64.

-linear
apply a linear enhancement to imagery data when it is loaded from disk.

-root
apply a square root enhancement to imagery data when it is loaded from disk.

-equal
apply an equalization enhancement to imagery data when it is loaded from disk.

Examples:

```
% fly -pci irvine.pix -cr 4 -cg 2 -cb 1 -ce 10 -linear

% fly -rgb mypicture.dat -e16u mypicture.elev -f 320 200 -ht 30 -ps 30
```

3.6 Main Window

The main window (or control panel) for FLY! allows the user basic control over the FLY! program as well as showing current information such as: position, flying direction, elevation and speed.

In the MenuBar are the following topics: File, View, Option, Nadir and Help. The File topic gives a menu of options for loading and saving data. The View topic gives a menu of options for altering how scenes are rendered. The Option topic gives a menu of options on reporting units or 3-D rendering. The Help topic gives access to the Online help.

3.7 Help on Online Help

The FLY! Help panel has three sections. The first, called the text window, is a large scrolled window holding text. The second section, called the topic list, shows

blue with 8 bits per color (32 bit RGB) with the alpha byte containing 0 (not used).

-rgb file
named file contains raw color information, pixel interleaved red, green, blue with 8 bits per color (i.e., 24 bit RGB).

-bw file
named file contains 8 bit black and white color information.

-r,g,b file
color data is in three separate files with the common named file and the following extensions: file.r must contain 8 bit red color information. file.g must contain 8 bit green color information. file.b must contain 8 bit blue color information.

-e16u file
named file contains 16 bit (unsigned) elevation data.

-e16s file
named file contains 16 bit (signed) elevation data.

-e8u file
named file contains 8 bit (unsigned) elevation data.

-dbsize x y
if files are not square (default) gives x and y size in pixels.

The following option switches are supported:

-ps size
gives the size of a pixel on the ground in meters. Pixels are assumed to be square. Default is 30 meters or taken from PCIDSK file header.

-es step
gives step (height) resolution of elevation data. Default is 1 meter.

-eo offset
gives offset value which represent the 0 meter elevation. Default is 0.

-f xsize ysize
gives size of output window in which rendered frames appear. Default is 512 by 350.

-hm factor
magnifies (exaggerates) heights by factor.

-xy x y
gives initial position. x,y are in pixels. Default is to start on middle of top edge.

-z z
gives initial height. z is in meters. Default is 500 meters

-fd direction
gives initial viewing (flight) direction in degrees. Default is 180.

Hill, Ontario, Canada.

3.3 Current Version

The current version of FLY! is 1.3, released October 1, 1992.

3.4 Customizing the Appearance of FLY!

Various resources of FLY!, such as fonts and colors, can be customized through the .Xdefaults file which resides in the user's login directory. The resources available are:

```
fly*fontList:              <font>   (e.g., fixed)
fly*HelpPopup*fontList:    <font>
fly*background:            <color>  (e.g., gray)
fly*MenuBar*background:    <color>  (e.g., thistle)
fly*DPosition*background:  <color>  (e.g., lightgray)
fly*DDirection*background: <color>
```

Available fonts and colors will depend on your system. Under some environments (e.g., HP VUE) customization is handled by means other than the .Xdefaults file. See the user documentation for these environments.

3.5 Command line Options

FLY! can be started automatically through the use of command line switches.

usage: **fly [files] [options]**

The following switches are used to specify the files for color and elevation information. Two file formats are supported: PCIDSK and raw. Files must be mod 8 in size.

PCIDSK data format is specified by the use of the -pci switch.

-pci file -cr i -cg j -cb k -ce e
: named file is in PCIDSK format. Numbers i, j, k and e give channels holding color and elevation. For black and white images, only the -cr and -ce switches are used.

Raw data contains no header or structure information and is indicated by the use of the -rgb (or -bw or -r,-g,-b) and -e (or -e8 or -e16) switchs. If the files are not square, the -dbsize option must be used.

-argb file
: named file contains raw color information, pixel interleaved alpha, red, green,

Chapter 3

Help Pages

These Help pages are also available on-line from within FLY!.

Please note that these pages describe the full functionality of FLY!. Your demonstration copy has limited functionality so not all the described functions will work. Most of the restrictions lie in loading different data sets/formats since your demonstration copy has been specially coded to only work with the provided data.

3.1 General

FLY! is a visualization tool which renders perspective scenes from color data draped over elevation data. Using proprietary, high speed algorithms, successive scenes can be generated to give the appearance of 'flying' through the data sets.

Typically an image taken from a satellite is draped over elevation data and FLY! is used to fly through the data from a person's perspective on the ground.

The user has full control over the flying elevation, direction and speed. Rendered scenes can be saved to disk in a variety of file formats for later use.

Sources of data include: satellite (Landsat, Spot, ...), air photo, scanners, and GIS systems.

3.2 Copyright

FLY! Release version 1.3

Technical Data Restricted Rights. Use, duplication or disclosure are subject to restrictions.

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It will take a while for FLY! to load and format the data files, often more than a minute, so be patient. When running one of the 3-D demos (that is **flybig3d**, **flysmall3d** or **flytiny3d**) you must wear the supplied Anaglyph (red and blue lensed) glasses.

To get you started working with FLY! a quick list of commands is presented below.

- When the mouse cursor is positioned in the rendering window, the mouse buttons have the following assignments: **left** - change direction to position pointed at; **middle** - toggle between run/pause; **right** - change elevation, bottom of window for low elevation, top for higher.
- In the View topic in the Menubar in the main window, select the Perspective popup and modify the perspective parameters. The height magnification is especially interesting.
- In the Nadir topic in the Menubar in the main window, select the image overview popup. When the mouse cursor is in the nadir image, the mouse buttons have the following assignments: **left** - move to pointed position; **right** - toggle between image/elevation.
- The rendering window can be resized by pulling on the frame.
- In the main panel there are two boxes showing the position and flight direction. When the mouse cursor is in the position box, the mouse buttons have the following assignments: **left** - move to position pointed at. When the mouse cursor is in the direction box the mouse buttons have the following assignments: **left** - change look and movement direction; **middle** - change look direction; **right** - make look direction same as movement direction.
- To exit FLY! use the Exit option in the File topic in the MenuBar.

If the rendered pictures appear dark, you can lighten them by using the **-root** or **-equal** options when you start any of the demo scripts. For example:

```
% flytiny -root          (or perhaps   % ./flytiny -root)
```

PCI encourages you to explore the other aspects of FLY!.

by the Landsat satellite on December 3, 1982, and is at 30 meters resolution. The elevation data is signed 16 bit with 1 meter height resolution. Both of these files are in PCIDSK format. **big.pix** represents an area of about 46km square (29 miles square), **small.pix** an area of about 31 km square (19 miles square), and **small.pix** an area of 15km square (10 miles square). All three files are geocoded to the UTM grid system. The files are in PCIDSK format which is compatible with PCI's EASI/PACE software.

The demo scripts are a single line text which are used to start the **fly** executable with appropriate command line options.

The **tiny** demonstration is suitable for workstations with 16 MBytes of RAM or less. The **small** demonstration is suitable for workstations with 16 to 32 MBytes of RAM or less. The **large** demonstration is for workstations with 32 MBytes of RAM or more.

2.2 Running the Demonstrations

To run the demonstrations, change directories to the one where the FLY! demonstration was loaded. For example, if the demonstration files are in **/usr/flydir**:

```
% cd /usr/flydir
```

You will now have to change to the directory containing the fly executable and demo scripts for your workstation. The available directories should be:

AUX	for Apple MacIntosh running AUX
DEC	for Digital DECstation 5000's
DG	for Data General AViiON's
HP	for Hewlett Packard 9000 series 700's
IBM	for IBM RISC System 6000's
IG	for Intergraph Interpro's
KP	for Kubota Pacific Titans
SCO	for PC's running SCO Unix
SGI	for Silicon Graphics IRIS's and INDIGO's
SUN	for SUN SPARCstations and SUN/4's
data	data files big.pix, small.pix, and tiny.pix

For example, if your workstation is an IBM Risc System 6000 change to directory IBM using the following command:

```
% cd IBM
```

To run a demonstration, select one of the demo scripts listed in the previous section and enter its name. For example:

```
% flytiny        (or perhaps   % ./flytiny)
```

Chapter 2

Running FLY! and the Demonstrations

To run the demonstrations you must be using a color monitor and either the Motif or OpenWindows graphical environment. It is best to use the main monitor for your workstation rather than an X-terminal since this will give better performance.

2.1 The Demonstration Data Sets

The following files make up the demonstrations:

README	Text file describing demonstrations
../data/big.pix	big demo data file, 1536 by 1536
flybig	demo script, big data set in true color
flybigbw	demo script, big data set in black and white
flybig3d	demo script, big data set in 3d
flybigfalse	demo script, big data set in false color
../data/small.pix	small demo data file, 1024 by 1024
flysmall	demo script, small data set in true color
flysmallbw	demo script, small data set in black and white
flysmall3d	demo script, small data set in 3d
flysmallfalse	demo script, small data set in false color
../data/tiny.pix	tiny demo data file, 512 by 512
flytiny	demo script, tiny data set in true color
flytinybw	demo script, tiny data set in black and white
flytiny3d	demo script, tiny data set in 3d
flytinyfalse	demo script, tiny data set in false color

The demonstration data files **big.pix**, **small.pix**, and **tiny.pix** are of Orange County, California (just southwest of Los Angeles). The imagery was acquired

1.5 Installing from Diskette

The installation instructions provided below are not as complete as the ones for tape. Some experience with using the tar facility and diskettes is assumed.

On systems without tape devices a *partial* FLY! Demonstration set is distributed on floppy diskette. Unlike the tape distribution which contains the fly program for a variety of machines and a choice of data sets the diskette distribution contains the fly program for a single machine and a single data set.

Two diskettes are supplied. One diskette contains the fly program and scripts (as described in section 1.3) for your computer type and the other contains the single data set **tiny.pix**. The data files **big.pix** and **small.pix** are not distributed so their scripts will not work.

Before reading the diskettes, create a new directory (or a new account) and then move to the directory. For example:

```
% mkdir flydir
% cd flydir
```

Insert the first diskette extract the files using tar. This command will vary from machine to machine. Below are some examples:

```
    % tar xvf /dev/fd0              (IBM Risc System 6000)
or
    % tar xv6                       (SCO Unix, 3 1/2" in A drive)
or
    % tar xvf /dev/rfd0a            (SUN SparcStation)
```

When the extraction is complete insert the other diskette and repeat the above command.

Two sub directories will have been created. One will be /bf data which contains the file **tiny.pix**. The other will vary depending on the type of machine, for example **SUN** or **SCO**, and will contain the fly program and scripts.

Often the fly program and data file will have been compressed using the UNIX compress utility, and will have to be uncompressed before they can be used. The following commands will do this:

```
% uncompress SCO/fly          (or SUN/fly, ... depending on system)
% uncompress data/tiny.pix
```

Chapter 2 explains how to run FLY! and the demonstrations.

1.4.10 Apple Macintosh running AUX

FLY! should work on Apple MacIntosh computers running AUX 3.0 with the X11 session manager active. It is recommended that only high end MacIntoshes be used (such as a Quadra 950).

Before reading the tape, create a new directory (or a new account) and then move to the directory. For example:

```
% mkdir flydir
% cd flydir
```

Insert the cartridge in the tape drive and extract the files using the following command:

```
% tar xv
```

About 40-50 Mbytes of files will be extracted. A description of the files is given in Section 1.3 of this chapter. Chapter 2 explains how to run FLY! and the demonstrations.

```
% tar xvf /dev/0m
```

About 40-50 Mbytes of files will be extracted. A description of the files is given in Section 1.3 of this chapter. Chapter 2 explains how to run FLY! and the demonstrations.

1.4.8 SCO Unix on PC

To work on a PC running SCO UNIX the following configuration is required. SCO UNIX V/386 rev 3.2 or later, with Xsight or Open Desktop. A 386 with 387 coprocessor or 486 CPU, at least 16Mbytes of RAM and a 1024x768 (or better) 256 color graphics card.

Before reading the tape, create a new directory (or a new account) and then move to the directory. For example:

```
% mkdir flydir
% cd flydir
```

Insert the cartridge in the tape drive and extract the files using the following command (this example assumes the tape drive is named **/dev/rct0**; yours may be different or may not be required): Insert the cartridge in the tape drive and extract the files using the following command:

```
% tar -xvf /dev/rct0
```

About 40-50 Mbytes of files will be extracted. A description of the files is given in Section 1.3 of this chapter. Chapter 2 explains how to run FLY! and the demonstrations.

1.4.9 Kubota Pacific Titan

FLY! should work on Titan 3000 workstation with G3 graphics adaptor running UNIX version 4.0 or later, and the Motif user interface.

Before reading the tape, create a new directory (or a new account) and then move to the directory. For example:

```
% mkdir flydir
% cd flydir
```

Insert the cartridge in the tape drive and extract the files using the following command:

```
% tar xv
```

About 40-50 Mbytes of files will be extracted. A description of the files is given in Section 1.3 of this chapter. Chapter 2 explains how to run FLY! and the demonstrations.

```
% mkdir flydir
% cd flydir
```

Insert the cartridge in the tape drive and extract the files using the following command (this example assumes the tape drive is named `/dev/nrst0`; yours may be different or may not be required).

```
% tar xvf /dev/rst0
```

About 40-50 Mbytes of files will be extracted. A description of the files is given in Section 1.3 of this chapter. Chapter 2 explains how to run FLY! and the demonstrations.

1.4.6 Data General AViiON

FLY! should work on any color AViiON workstation running DG/UX Version 4.1 or higher.

Before reading the tape, create a new directory (or a new account) and then move to the directory. For example:

```
% mkdir flydir
% cd flydir
```

Insert the cartridge in the tape drive and extract the files using the following command:

```
% tar xv
```

About 40-50 Mbytes of files will be extracted. A description of the files is given in Section 1.3 of this chapter. Chapter 2 explains how to run FLY! and the demonstrations.

1.4.7 Intergraph Interpro

FLY! should work on any color Intergraph Interpro workstation, models 2000, 3000 or 6000 (C300 CPU based models). Version 5.0 of CLIX or later is required with X11 and Motif runtime.

Before reading the tape, create a new directory (or a new account) and then move to the directory. For example:

```
% mkdir flydir
% cd flydir
```

Insert the cartridge in the tape drive and extract the files using the following command (this example assumes the tape drive is named **/dev/0m**; yours may be different or may not be required):

1.4.3 Hewlett Packard 9000 Series 700

FLY! should work on any color Hewlett Packard 9000 Series 700 workstation running HP-UX Version 8.01 or above.

Before reading the tape, create a new directory (or a new account) and then move to the directory. For example:

```
% mkdir flydir
% cd flydir
```

Insert the cartridge in the tape drive and extract the files using the following command:

```
% tar xov
```

About 40-50 Mbytes of files will be extracted. A description of the files is given in Section 1.3 of this chapter. Chapter 2 explains how to run FLY! and the demonstrations.

1.4.4 Digital DECstation 5000

FLY! should work on any color DECstation 5000 workstation running Ultrix Version 4.1 or above. Either the DECwindows or Motif window manager can be used.

Before reading the tape, create a new directory (or a new account) and then move to the directory. For example:

```
% mkdir flydir
% cd flydir
```

Insert the cartridge in the tape drive and extract the files using the following command:

```
% tar xv
```

About 40-50 Mbytes of files will be extracted. A description of the files is given in Section 1.3 of this chapter. Chapter 2 explains how to run FLY! and the demonstrations.

1.4.5 SUN SPARCstation

FLY! should work on any color SUN SPARCstation, SPARCserver or SUN/4 workstation running SunOS 4.1 or higher. FLY! will work with either OpenWindows 3.0 or Motif 1.1.

Before reading the tape, create a new directory (or a new account) and then move to the directory. For example:

Please note that two extra files are extracted which are not listed in Section 1.3. These are **fly.gl** and **fly.x**. Both of these files are FLY! executables: **fly.gl** requires that the **gl** library option be installed on your system; **fly.x** is the generic X version and should run on any system. The excutable **fly** is the same as **fly.gl**. If you have difficulties running **fly** because the **gl** option is not installed or because you are running on an 8 bit color system, or you wish to use an X-terminal, the **fly.x** version will be required. The following command should be used to set this up:

```
% cp fly.x fly
```

Chapter 2 explains how to run FLY! and the demonstrations.

1.4.2 Silicon Graphics IRIS and INDIGO

FLY! should work on any Silicon Graphics Personal IRIS, Power IRIS or INDIGO workstation running IRIX Version 4.0.1 or above. On Power IRIS workstations with multiple CPU's, FLY! will automatically run in parallel using all available CPU's to increase rendering speed.

Before reading the tape, create a new directory (or a new account) and then move to the directory. For example:

```
% mkdir flydir
% cd flydir
```

Insert the cartridge in the tape drive and extract the files using the following command:

```
% tar xovf /dev/tape
```

Note: SGI cartridge drives are byte swapped from most other vendors. If the above `tar` command does not work (i.e., results in a checksum error message) the following command may work:

```
% tar xovf /dev/tapens
```

About 40-50 Mbytes of files will be extracted. A description of the files is given in Section 1.3 of this chapter.

Please note that two extra files are extracted which are not listed in Section 1.3. These are **fly.nopar** and **fly.par**. Both of these files are FLY! executables: **fly.nopar** is for single processor systems; **fly.par** is for parallel (multiprocessor) systems. By default the executable file **fly** is the same as **fly.nopar**. If you have a multiprocessor system, the following command will enable the demonstrations to use the parallel version:

```
% cp fly.par fly
```

Chapter 2 explains how to run FLY! and the demonstrations.

flybig3d	demo script, big data set in 3d
flybigfalse	demo script, big data set in false color
flysmall	demo script, small data set in true color
flysmallbw	demo script, small data set in black and white
flysmall3d	demo script, small data set in 3d
flysmallfalse	demo script, small data set in false color
flytiny	demo script, tiny data set in true color
flytinybw	demo script, tiny data set in black and white
flytiny3d	demo script, tiny data set in 3d
flytinyfalse	demo script, tiny data set in false color

The only critical file is the FLY! executable file **fly**. All the other files are for demonstration purposes only and can be deleted.

The files **big.pix**, **small.pix**, and **tiny.pix** contain the demonstration data sets. The demo scripts are a single line of text which are used to start the **fly** executable with appropriate command line options.

1.4 System Specific Instructions

The following sections describe the specific installation procedure for each type of workstation. You need only follow the instructions in the section which pertains to the workstation you will be reading the tape on.

Please note that the example **tar** commands used in the installation procedures below may not be exactly the same as that required for your system. Typically the differences are in whether the tape is the default device for **tar** or whether it must be explicity reference by its full device name. If in doubt contact your system manager.

1.4.1 IBM Risc System 6000

FLY! should work on any color IBM Risc System 6000 workstation running AIX Version 3.2 or above.

Before reading the tape, create a new directory (or a new account) and then move to the directory. For example:

```
% mkdir flydir
% cd flydir
```

Insert the cartridge in the tape drive and extract the files using the following command:

```
% tar xv
```

About 40-50 Mbytes of files will be extracted. A description of the files is given in Section 1.3 of this chapter.

The FLY! program relies on fast, proprietary, rendering algorithms, to achieve quick rendering times. There is no requirement for any extra special hardware.

1.2 Distribution Checklist

Your distribution should include the following items:

- The *FLY! Installation and User Guide*
- Anaglyph (red and blue lensed) Glasses for 3-D Viewing
- A computer cartridge tape (QIC, 8mm, TK-50 or 4mm DAT)

The cartridge tape is in UNIX tar format and contains about 40-50 MBytes of files.

A special distribution is sometimes made using two floppy diskettes instead of cartridge tape. If you have recieved such a distribution skip to section 1.5 in this chapter.

1.3 Overview of Distributed Files

The following list describes the directories and files which are on the distribution tape.

Each FLY! Demonstration tape contains the FLY! executables for many different workstations. After installing the software on your system you can delete the unneeded versions. The following directories will be created automatically:

AUX	for Apple Macintosh running AUX
DEC	for Digital DECstation 5000's
DG	for Data General AViiON's
HP	for Hewlett Packard 9000 series 700's
IBM	for IBM RISC System 6000's
IG	for Intergraph Interpro's
KP	for Kubota Pacific Titans
SCO	for PC's running SCO Unix
SGI	for Silicon Graphics IRIS's and INDIGO's
SUN	for SUN SPARCstations and SUN/4's
data	data files big.pix and small.pix

Within each of these directories (other than the **data** directory) will be the FLY! executables and demonstration scripts described below:

fly	FLY! executable program
README	Text file describing demonstrations
flybig	demo script, big data set in true color
flybigbw	demo script, big data set in black and white

Chapter 1

Installing FLY!

Thank you for spending the time to install and run the FLY! demonstration. PCI hopes that you will find the installation a simple process and the FLY! demonstration enjoyable.

Please note that your demo copy of FLY! is fully functional *except* that it will only work with the supplied demonstration data sets.

To get started as quickly as possible PCI suggests you proceed through this manual as follows:

1. Section 1.1 **Hardware Requirements**
2. Section 1.2 **Distribution Checklist**
3. Section 1.4 **System Specific Instructions**
4. Chapter 2 **Running FLY! and the Demonstrations**

This entire process usually takes less than 30 minutes.

1.1 Hardware Requirements

FLY! will run on most color UNIX workstations with the following minimum configuration:

- UNIX operating system
- 8 bit *or* 24 bit color capability
- Motif V1.1 *or* OpenWindows 3.0 Graphical User Interface
- *At least* 16 Mbytes of RAM

Preface

Intended Audience

This manual provides a reference to the user of the Demonstration version of the FLY! program.

Structure of the Manual

This manual contains three chapters documenting: software installation; running FLY! and the supplied demonstrations; and help pages on the FLY! program.

Release Notes

This manual reflects the addition of the Apple Macintosh computer running Apple Unix (AUX) some minor bug fixes over Version 1.2 of FLY!, and a discussion of installation from diskette.

Contents

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FLY!™ Demo
Installation and User Guide

Version 1.3

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