D. IRIS 3D

D.1 Introduction

Overview

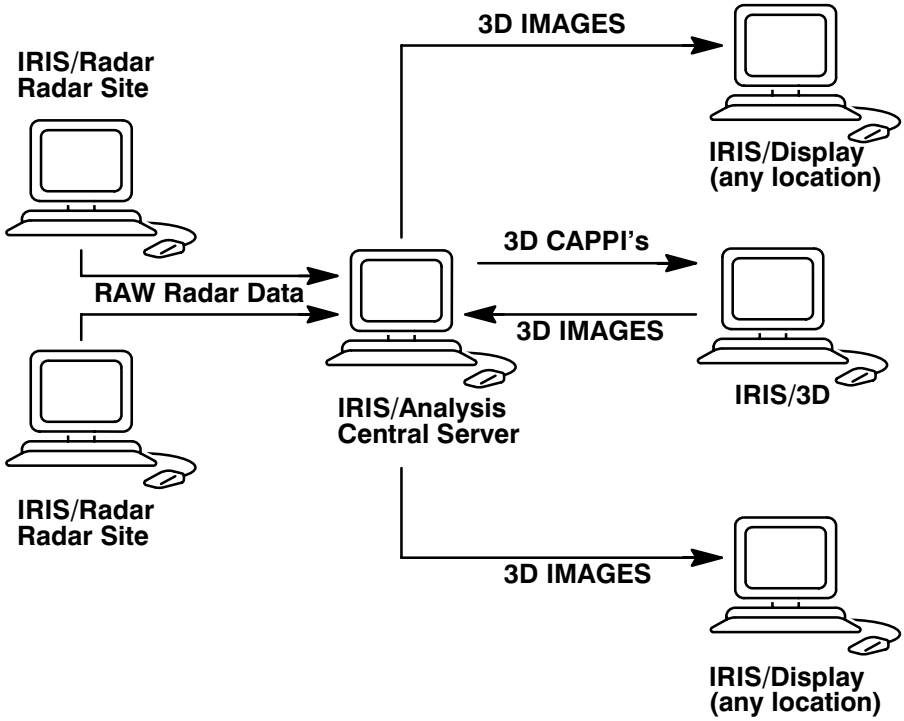
The IRIS / 3D software is a separately licensed software package available from SIGMET that renders IRIS format radar data in a 3D view window. IRIS/3D runs on a normal PC running the Microsoft Windows operating system. The input radar data may be data collected from a single weather radar, or from an IRIS composite of multiple radars. The viewer fully supports rotation, translation, zoom, etc.. as would be expected with a 3D viewer. The radar echoes appear in full color, and the image includes a detailed 3D terrain map of the land and water underneath the weather echoes.

The software runs on either an HP or SGI workstation. The software must be run on a dedicated computer, since the 3D functions require the full CPU power of the computer, and also use the complete color table.

IRIS/3D Place in System Architecture

The IRIS/3D package fits into the overall architecture of an IRIS system as shown in the figure below. Generally, there is an IRIS/Radar package running the IRIS software at a remote radar site (or perhaps there are multiple remote radar sites). Raw radar base data are fed from the radar sites to a central server computer running IRIS/Analysis software generating many 2D radar products. These products may be viewed directly on this central server computer, or re–distributed to other client computers running the IRIS/Display software package. For 3D functions, the central server computer outputs a series of 3D CAPPI products over the network to the IRIS/3D workstation. The IRIS/3D PC receives these data and displays it in the 3D rendering window. At the 3D rendering window, the operator may manipulate the data by rotating, translating, zooming, changing data thresholds, etc. During manipulation, the images are viewed in true 3D form. Any 3D image viewed on the IRIS/3D computer can then be sent back to the central server computer for viewing and distribution to other client computers on the network running IRIS/Display. So in summary the 3D functions (rotation, etc.) are only available at the IRIS/3D workstation. However 2D versions of the 3D renderings are available to any IRIS workstation on the network.

Figure D–1: IRIS 3D Data Flow



IRIS/3D High Level Functions

The IRIS/3D computer can be configured for one of two different high–level functions. The computer can either be used in a manual mode, or in a fully automatic mode.

In the manual mode, as new data are made available from the central server computer, it is not automatically rendered in the 3D window, nor are 3D products automatically sent back to the central server computer. In this mode, the incoming data from the central server is added to an inventory on the IRIS/3D computer. An operator can then select the data from the inventory to be rendered and then, optionally, send that rendered 3D image back to the central server.

In the automatic mode, as soon as a 3D CAPPI comes in from the central server computer, it is rendered in 3D in the window using a pre–set view, and then the rendered 2D image is automatically sent to the central server computer. Again, the central server computer can view that image locally in a window, or distribute it to other IRIS/Display workstation, etc.. The automatic mode requires some setup (i.e., setting of a pre-defined view point, etc.), but no interaction at runtime.

When the 3D products are finally viewed on an IRIS workstation, they can take full advantage of the IRIS window functions. This includes animation looping, color printing, conversion to GIF or JPG for web page insertion, etc..

D.2 Using the IRIS/3D Software

Starting IRIS/3D

To start the IRIS/3D software, simply click the icon for IRIS/3D on your IRIS/3D PC.

The IRIS/3D software is primarily controlled by using the mouse. When the software starts, two windows are presented to the user. The window on the left is for manual, or "Interactive" use, and the window on the right is for "Automatic" rendering and sending of images to IRIS. We will refer to these windows as the Interactive and the Automatic window in the documentation. After the user confirms the start–up prompt, he is presented only with the Interactive window. The Automatic window can be brought up later and configured for its viewing perspective for automatic product generation.

Only one window is ever on the screen at a time. This is because both windows share the same 3D engine. The Automatic window has priority. This means that if new data comes in from the IRIS central server, and the Interactive window is displayed, it will be forced to pause while the invisible Automatic window uses the engine to render a 3D product and send it to IRIS. When this operation is complete, control is returned to the interactive window.

Using the Mouse to Control the View

The view that is always presented when the software starts is a direct downward view. You can think of viewing the data as if looking through a camera. The location of the camera is controlled by the user. At startup, the camera is high in the sky looking straight down on the earth. The camera can be moved (translated) with respect to the view. The camera can zoom as if it had a zoom lens. Also, the object can be rotated with the camera staying stationary. With all of these controls, any arbitrary vantage point can be achieved. For example, the camera could be moved to the surface of the earth and then look up at the sky, or to the north, etc.. The camera could even be placed inside of a cloud to see what is inside of an echo.

The left mouse button controls rotation of the object about the camera. When rotating the object, the mouse is placed at some point on the object, the center button pressed, the mouse dragged and then the center button released. In this mode the object could be thought of as a rigid piece of cardboard. The point of the mouse when the button is pressed is the piece of the cardboard that will be moved. The direction that the mouse is dragged is the axis about which the cardboard is rotated.

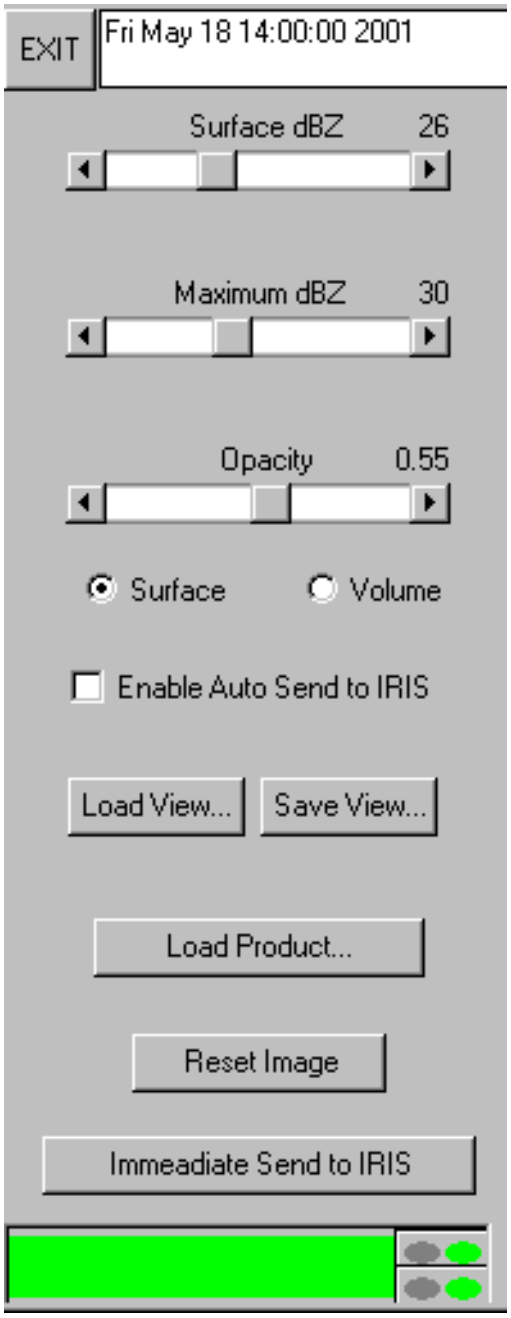
The center mouse button has the effect of moving the camera with respect to the object. As the mouse is dragged left, the object appears to move to the left, and likewise for other directions.

The right mouse button performs Z–translations of the camera with respect to the object. In other words, the distance between the object and the camera is changed when using the right mouse button. This allows the camera to actually move into,

and even through parts of the object. As the right mouse button is press and the mouse is dragged down, the camera moves toward the object, and likewise when dragged up, moves away from the object.

By using all of the above mouse functions, any conceivable view can be achieved. If during a mouse movement the mouse button is released while the mouse is still in motion, the active rotation or translation or zoom will continue until a mouse button is pressed. This allows for "fly through" of the data.

The Window Control Panel

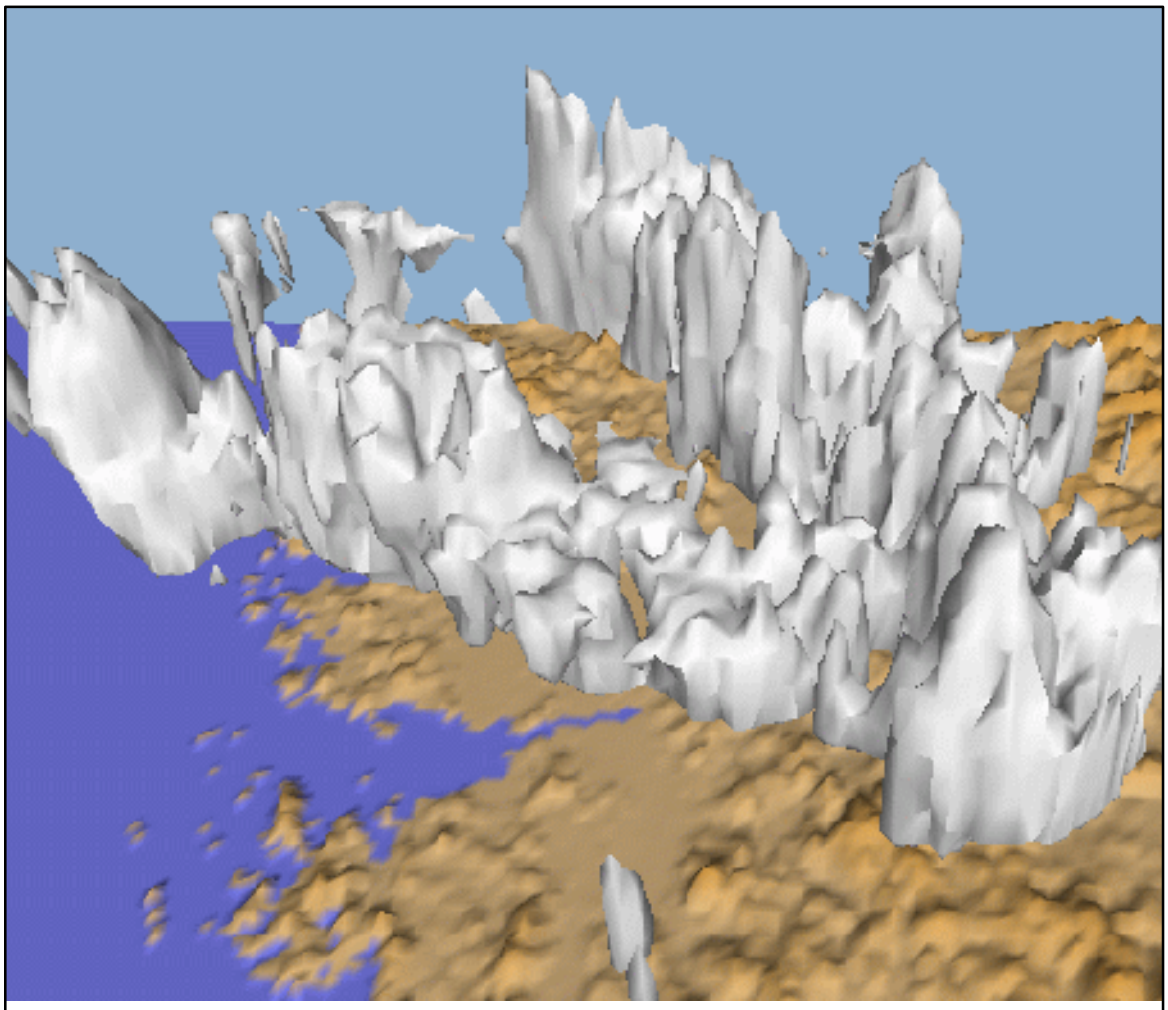


The control panel that is attached to the left side of the data window allows provides for some additional rendering controls, and for file controls.

Rendering Modes

The highest level function on the control panel is the selector buttons for either “Surface” or “Volume”. Surface and Volume refer to two different rendering modes. Surface rendering mode is easier to understand as it has fewer controls associated

with it. In surface rending mode, the echoes appear as various shades of white, similar to clouds. The only rendering control that is active during surface rendering mode is the slider called “Surface dBZ”. Surface rendering mode in 3D terminology is actually an iso-surface. In other words, for example, if the Surface dBZ control is set at 30 dBZ, all of the echo that is less than 30 dBZ is removed from the picture and what you see is a shape that represents the outer boundary of the 30 dBZ echo. In some ways it is similar to a traditional 2D echo tops radar product, but it is extended to not only the top of the echo, but also to all sides of it. For example, if 30 dBZ constitutes a threshold that you wish to monitor, you could do this by making a surface rendering set at 30 dBZ. If nothing appears on the screen, this means that there are no echoes 30dBZ or greater present. If echoes of at least 30 dBZ are present, the outer parts of the clouds that are less than 30 dBZ are removed and you only see these 30 dBZ cores. The lower this threshold is set, the more data you are likely to see.

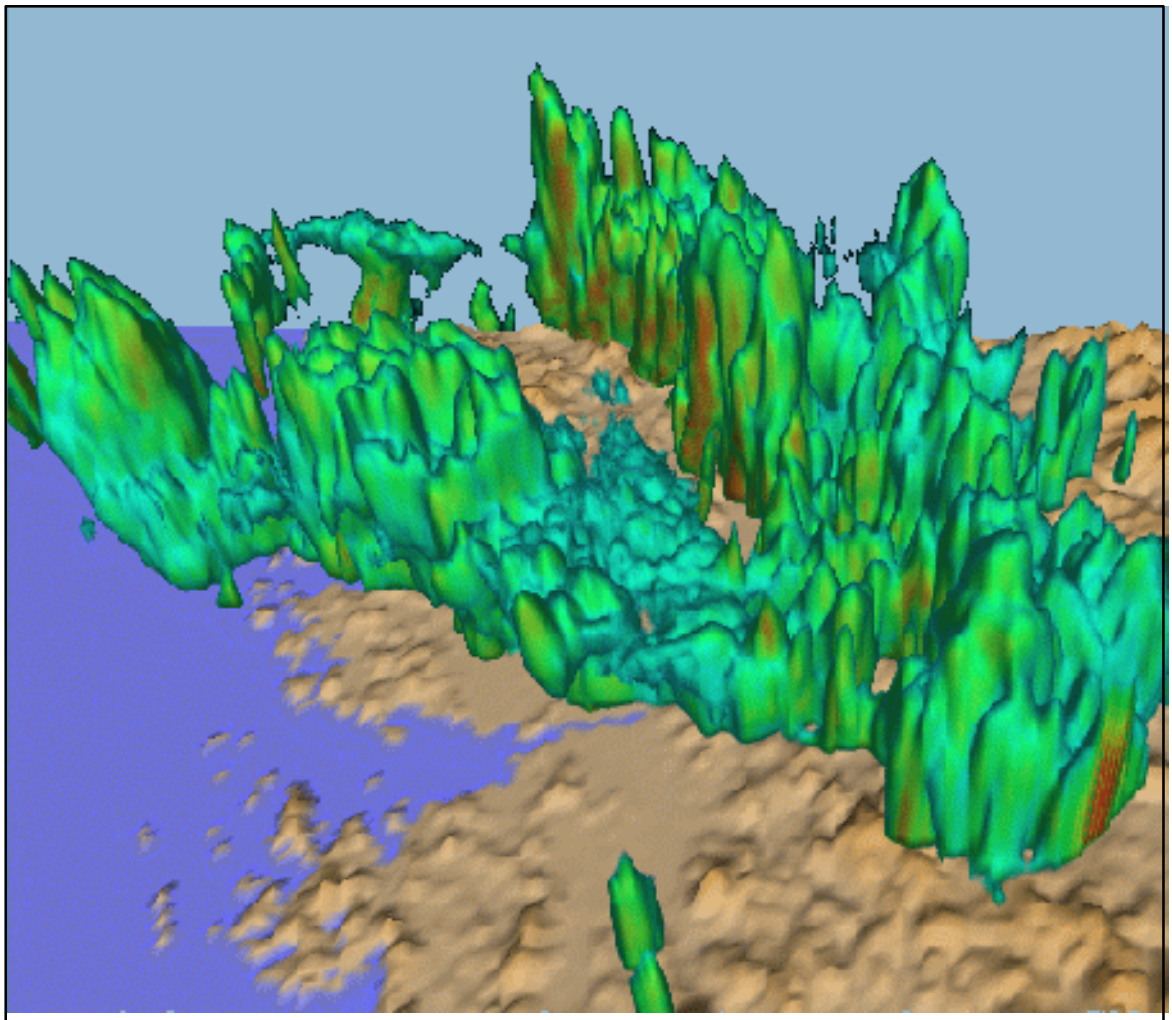


Example of Iso-Surface Rendering

The other mode of rendering is Volume rendering. To enable volume rendering, press the “Volume” button. In volume mode, there are three rendering controls to use. The first two are the “Minimum dBZ” and the “Maximum dBZ”. There can be thought of as filters, or thresholds. Only data that is between the minimum and maximum values is used. All other data outside of this range is filtered out and not displayed. The third control is the “Opacity” control. As it’s name implies, this controls how opaque the data appear.

In volume rendering mode, you can get a sense for both what is inside of an echo as well as the appearance of the surface of the echo. This is where the “Opacity” control fits in. The more opaque (greater the Opacity), the more difficult it is to see inside of an echo. The less opaque, the more transparent an echo becomes and it is easier to

see inside of the echo. So in summary, in volume rendering mode, you can think of yourself as having "X–Ray Vision". The more you lower the opacity, the more powerful your X–Ray Vision becomes.



Example of Volume Rendering

Unlike surface rendering which is done in only shades of white, volume rendering is done in a full spectrum color scale. Blues represent the weakest echoes, building up to greens, yellows, oranges and finally reds. The color scale is NOT absolute, but instead relative. Relative to the Minimum and Maximum dBZ slider setting. In other words, if the Minimum dBZ is set to 10 dBZ and the Maximum dBZ is set to 30 dBZ, echoes of 10 dBZ appear as blue and echoes of 30 dBZ appear as red.

Volume rendering mode is more CPU intensive than surface rendering mode, but in tradeoff, it provides a full color picture of the inside and the outside of the weather, while surface mode just provides a mono–color view of a surface. Being more CPU

intensive, in volume rendering mode, the object renders as a volume when there is no mouse activity. But when there is mouse activity (i.e., the object is being rotated or translated), the object is rendered as a surface. This allows for more rapid updates during redraws. When the mouse button is released, the surface render is replaced by the full color volume rendering.

Sending of 3D Images to IRIS

When images are sent from the IRIS/3D computer to the IRIS central server computer, the IRIS central server computer receives them and adds them to it's product inventory as products of type "IMAGE". In IRIS, IMAGE products are accessed for viewing in windows just like any other product. Also, printing, re–distribution, or archiving of IMAGE products is done using the IRIS Product Output Menu.

From the interactive IRIS/3D window, the current image can be sent to the IRIS central server computer immediately by pressing the "Immediate Send to IRIS" button. When this button is pressed, the IMAGE product will be sent to the server.

To automatically render all data that arrives, press the button on the control panel labeled "Enable Auto Send to IRIS". When this button is pressed, it causes any CAPPI cube products sent to the 3D workstation from the server computer to be rendered immediately (as opposed to only added to the available inventory). Once rendered, the 2D image is sent back to the IRIS server computer. A few notes:

- Generally, do not press the "Enable Auto Send to IRIS" button until you have selected your final view perspective. If while the Enable button is pressed in you make a change to your view, the 3D computer will continuously send IMAGE product to IRIS. This is slow and probably undesirable.

Miscellaneous Operations

The control panel offers a "Load Product" button. This button presents a menu of the data available for rendering. From this menu, the operator can choose any of the data by clicking the time, and pressing "OK". In the case of the Automatic window, if automatic sending is "Enabled", once the loaded product is rendered, it is immediately sent to IRIS as an IMAGE product. Of course an IMAGE can also be sent manually by pressing the "Immediate Send to IRIS" button.

The control panel also has a button labeled "Reset Image". This button causes the viewing perspective to be reset to a top down view. This is handy because sometimes you may find that you actually get lost in the clouds. To find yourself again, you can always reset the view.

The control panel has a color bar at the bottom of the control panel. This color bar represents the status of the 3D rending engine. When the color bar is green, the engine is idle. When red, it means the engine is running and actively rendering a new view. To the right of the bar are two oval buttons. The top one controls the engine.

By pressing the top oval, the 3D engine is stopped. This will prevent the engine from rendering new data. Any attempts to change the view, or thresholds will have no effect. This is convenient when the operator wishes for example makes a mistake in the setting of the view and does not want to wait for the engine to render the view. The operator can stop the engine, then restart it, then change the view again. This may save several seconds depending on the complexity of the view. The bottom oval controls only the updating of the status bar. If pressed and made red, the status bar will stop updating (but the engine will run normally and render data).

It should also be noted that the size of window is adjustable. This is simple done by dragging a corner of the window. This way a 3D window could be made to take up the full screen. This actually makes a stunningly beautiful 3D presentation. It should be noted however, that the larger the window, the longer it will take to render new data or new views.

The control panel also has an “Exit” button. Pressing this and its confirmation prompt will immediately shutdown the IRIS/3D software.

D.3 Installation and Configuration

The installation is in four parts. First, the installation on the actual IRIS/3D software on the Windows PC is discussed. Second, the installation of the interface programs onto the UNIX machine that is running the IRIS software is discussed. Third, a method to provide for transfer of data between the UNIX station and the Windows PC is discussed. Fourth, the IRIS software itself must be setup with an output device to send allow sending of products to the IRIS/3D software. These four parts are described below:

PART 1 – INSTALLATION OF IRIS/3D SOFTWARE ON RENDERING PC

1) Insert the IRIS CD into the PC CDROM drive.

2) Open a DOS TOOL window and execute the instructions in the next several steps.

3) Make a directory called c:\iris3d
   (mkdir c:\iris3d).

4) Copy the zip file from the CDROM to the disk
   (copy d:\iris3d\iris3d.zip c:\iris3d).

5) Copy the unzipping utility from the CDROM to the disk
   (copy d:\iris3d\pkunzip.exe c:\iris3d).

6) Unzip the zip file
   (cd c:\iris3d)
   (pkunzip –d iris3d.zip)

7) Copy the 3D base map of your area to the root directory. For example to use the Hong Kong base map:
   (copy c:\iris3d\maps\base_map.hko c:\base_map.dat)

8) Copy the Views map to the root directory.
   (copy c:\iris3d\maps\3d_views.dat c:\)

9) Copy the example data file for your area to the root directory. For example, to use the Hong Kong example data file:
   (mkdir c:\data_out)
   (copy c:\iris3d\data\file0.hko c:\data_out\file0)

10) Copy the library files to your system area
   (copy c:\iris3d\libs*.* c:\windows\system)

11) Place the license file into the license directory. The license file is not found on the CDROM, but it is distributed to you independently from SIGMET.
   (mkdir c:\flexlm)
   Put the license file into the c:\flexlm directory and call it license.dat

12) Edit the c:\autoexec.bat file and place the following onto a separate line in the file. You an use the DOS ”edit” command to do this.
@set XP_FEATURE=XP_RUNTIME

13) The IRIS/3D program can now be run. To run the program execute:
c:\iris3d\bin\pc\express.exe
Note that you can optionally make an icon on your desktop to do this.

PART 2 – INSTALLATION OF INTERFACE PROGRAMS ON UNIX STATION

1) Place the CDROM into the UNIX station and mount it.

2) As user ”operator”, copy the tar file containing the interface programs to the /home/operator/bin directory. Create this directory if necessary. The tar file to use is defined below:
ALL: (cd /home/operator/bin)
Linux: (cp /mnt/cdrom/iris3d/linux.tar ./interface.tar)
HPUX: (cp /cdrom/IRIS3D/HPUX.TAR\;1 ./interface.tar)
IRIX: (cp /CDROM/iris3d/irix.tar ./interface.tar)

3) Untar the programs the program:
(tar cvf interface.tar)
(rm interface.tar)
This creates the following five programs:
cappi_receiver
receiver.dat
avs_sender
sender.dat
S99iris3d

4) Arrange that the interface programs start automatically on system boot.
As root, perform the following:
ALL: (chown root /home/operator/bin/S99iris3d)
(chgrp sys /home/operator/bin/S99iris3d)
Linux: (cp /home/operator/bin/S99iris3d /etc/rc.d/rc3.d)
HPUX: (cp /home/operator/bin/S99iris3d /sbin/rc2.d)
IRIX: (cp /home/operator/bin/S99iris3d /etc/rc2.d)

Next time the machine is rebooted, the interface programs will automatically start. These programs run silently in the background and have no operator interface.

PART 3 – SETUP OF FILE TRANSFER MECHANISM

It is necessary for IRIS products to be transferred from the UNIX station to the Windows PC so that the PC can render them in 3D. And also, after rendering the Windows PC can transfer the resulting images back to the IRIS UNIX station for viewing in an IRIX window. To accomplish this a file sharing mechanism must be setup between the UNIX station and the Windows PC. There is one way

recommended to do this that is discussed here, and perhaps there are others as well that are not discussed here. The recommended way is to run a software suite on the UNIX computer known as ”SAMBA”. A PC running MS Windows can setup a shared drive to a UNIX station running the SAMBA software. SAMBA is a freeware software package that is often shipped with the operating system as optional software. If you use SAMBA, you should configure it to make an exported directory on the UNIX station that is WRITABLE by the guest account and has the user ”operator” as the guest account. We recommend making this exported directory be the ”/usr/iris_data” directory. Next, make the following two subdirectories:

/usr/iris_data/iris3d :
/usr/iris_data/gif_out

Make sure both directories are owned by ”operator” and have permissions of 775. Next, on the MS Windows PC running the IRIS/3D software, setup a network drive pointing to this directory on the UNIX station. This network drive should be configured to automatically reconnect at boot time. The IRIS/3D software on the PC requires the network drive to have the ”E:” designation.

PART 4 – SETUP OF IRIS SOFTWARE

1) Configure a network output device in your IRIS UNIX station to output to the IRIS/3D station via the interface program.
   FILE FORMAT: IRIS (DEFAULT)
   FILENAME FORMAT: NATIVE
   DATA FORMAT: NORMAL
   NOTIFICATION SCHEME: TCPIP
   TARGET DIRECTORY: /usr/iris_data/iris3d/
   COPY SCHEME: COPY
   NOTIFICATION PORT: 30740
   RECIPIENT NODE NAME: <enter your local node name here>

2) The configuration files for the interface programs (PART 3) must agree with the above information. The configuration file ”receiver.dat” controls the receiving of the data from IRIS.

This file should take the format of:

   LOG 0
   NOTIFY 30740 /usr/iris_data/iris3d/

This tells the receiver to listen for the notification message on TCPIP port 30740 and then look for the file in the /usr/iris_data/iris3d directory. The configuration file ”sender.dat” controls the sending of the data resulting rendered images to IRIS. This file should take the format of:

LOG 0
IRIS <your IRIS station hostname> 30725 /usr/iris_data/product/
AVS /usr/iris_data/gif_out/

This tells the sender to send place the images in the usr/iris_data/product/ directory and send a TCPIP notification message to the local IRIS node on port 30725. Furthermore, the sender expects to find the images to send (coming from the MS Windows PC) in directory usr/iris_data/gif_out.

The main setup that is particular to the use of the IRIS/3D is the product configuration of a 3D CAPPI product. A CAPPI cube product must be configured, as this is the data that the IRIS/3D requires as input. The CAPPI cube should be configured to use Z:dBZ data type. The CAPPI Height should be 0.5 to 12.5. This is for proper scaling with respect to the 3D base map. The resolution must be 400x400x30. The product must be of DATA type. All other parameters are left to the users to choose. Note in particular the Max Range. This can be set to any reasonable value and the IRIS/3D software will scale the data to the base map appropriately. Also note that projections can be used. If used, the projection should be of type AED. Again, the center and max range of the projection can be any reasonable value.

Once the product is configured, it may be scheduled to run in the Product Scheduler Menu. Then by using the Product Output Menu, it can be either manually or automatically sent to the IRIS/3D computer. See the chapter in the *IRIS User's Manual* for details about the product scheduler menu and the Product Output Menu.