

1. Introduction to IRIS

IRIS is an advanced hardware and software product for either Doppler or non-Doppler weather radar applications. IRIS was developed by SIGMET, Inc., to provide virtually all of the features required for the operation of a radar network and distribution of radar products, including:

- Local and remote radar control.
- Real time display for the local or networked workstations.
- PPI, RHI and interactive, manual scanning.
- Advanced radar signal processing and control features for data acquisition.
- Advanced radar product generation — CAPPI, PPI, RHI, vertically integrated liquid, echo tops, cross section, maximum reflectivity, wind shear, and rainfall accumulation — with full interpolation in polar coordinates.
- Centroid definition with automatic warnings.
- Forecaster features like loop, geographic cursor, storm tracking and forecasting, and interactive cross section modes.
- Archiving and playback of products and raw data.
- Comprehensive alignment and calibration.
- Comprehensive diagnostic and system monitoring.
- Product generation from both real time and archived data.

In this chapter:

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1.1 Types of IRIS Systems

Three types of IRIS system are available:

- | | |
|----------------------|--|
| IRIS/Radar | Installed at the radar site, the IRIS/Radar system runs the radar and signal processing hardware, generates ingest files and raw data for other IRIS sites. It can support either the basic or the full product set. |
| IRIS/Analysis | Installed at a central office, the IRIS/Analysis system receives raw data products from the radar site over the network or from an archive device, such as a tape or optical disk. It supports the full product set. Remote control and monitoring are also supported. |
| IRIS/Display | Installed at remote workstations, the IRIS/Display system receives processed product files or raw data over the network or from an archive, and uses them for display purposes. It supports the basic product set. Remote control and monitoring are also supported. |

1.2 IRIS Hardware

IRIS is an integrated hardware and software product. The hardware components are shown in Figures 1–1 and 1–2 for typical configurations of a standard IRIS System.

1.2.1 Workstation

IRIS can run on the following computer systems:

- HP Workstation 9000 series, running the HP-UX operating system.
- PC running the LINUX operating system

The workstation can run the IRIS processes and menus, or function as an output device for IRIS products.

1.2.2 Signal Processor

The signal processors supported by IRIS are the RVP6, RVP7, and RVP8 floating-point programmable radar video processors. They can be expandable by the addition of processing cards, and programmed to perform virtually any radar signal processing task. The RVP8 is an innovative standard computer PCI based solution that harnesses the processing power of today's computer processors.

The signal processor connects to IRIS via a SCSI2 interface (RVP6/7) or TCP/IP connection. The signal processors are self-testing. The green GO light indicates that the processor has passed its power-up self-tests. The red USER light on the RVP6/7 indicates that IRIS is properly talking to the processor. The light does not turn on until IRIS is started.

IRIS provides an extensive software package for signal processor test and alignment. Refer to the *IRIS Utilities Manual*.

1.2.3 Radar Control Processor

The Radar Control Processor (RCP) handles the microprocessor control of the radar transmitter/receiver and antenna system. It is supplied either by the radar manufacturer or SIGMET (Model RCP02). Through the RCP, IRIS can control such things as the radiate ON/OFF, the power to various parts of the system, the antenna motion, as well as obtain status on critical components such as the waveguide pressure and the cooling airflow.

Figure 1-1: Example of IRIS Configuration

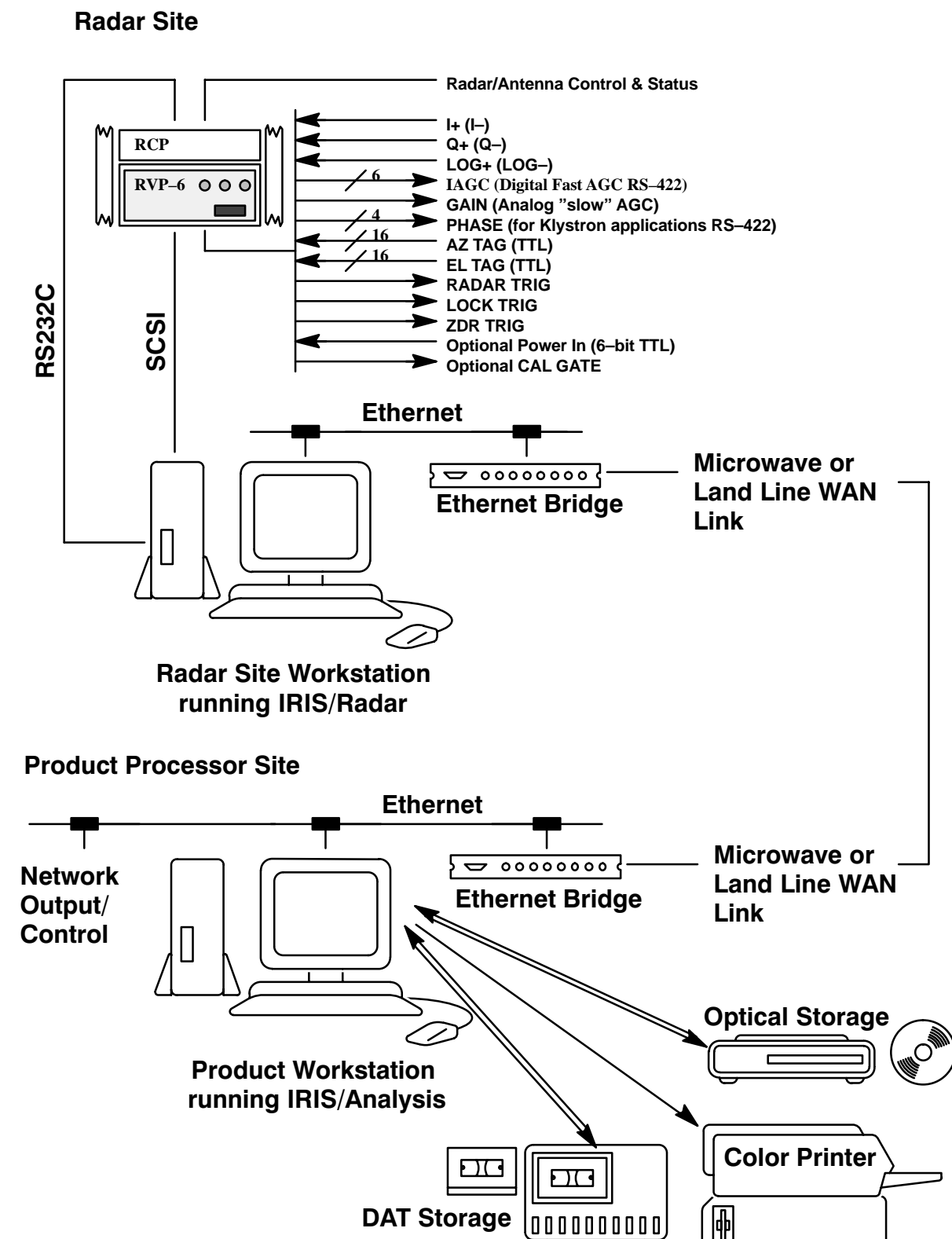
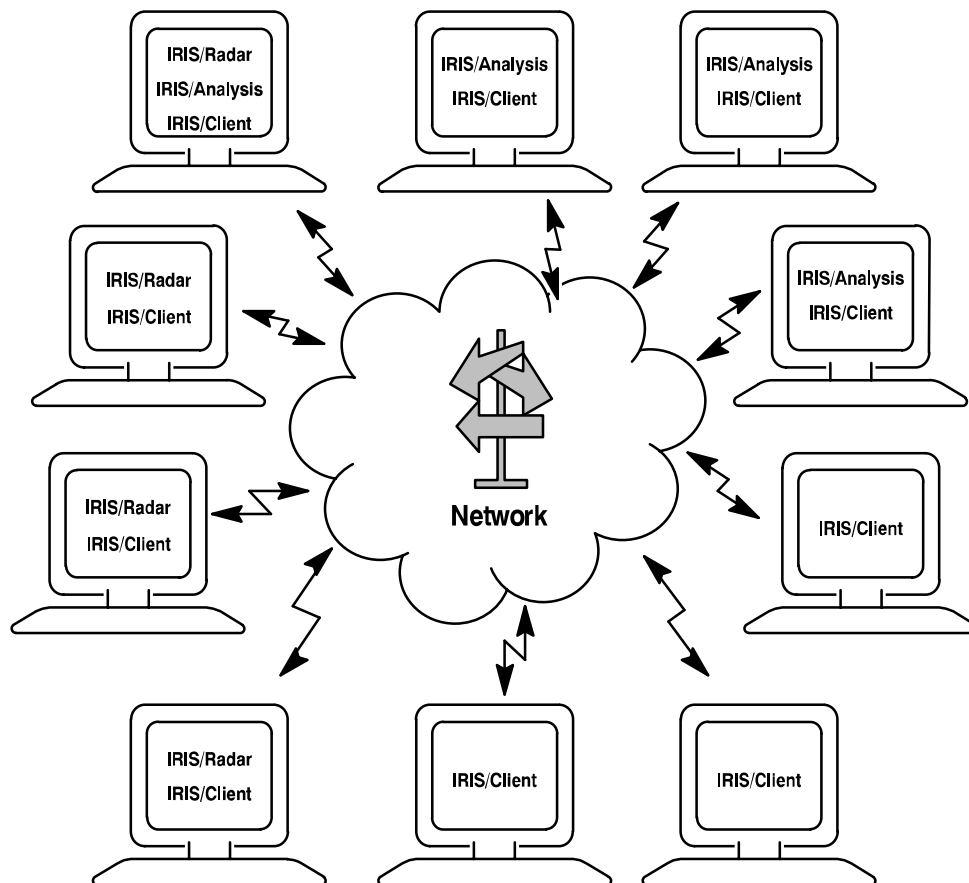


Figure 1–2: Schematic of Network IRIS Connections



The RCP connects to the host computer via an asynchronous serial line or a standard TCP/IP network connection. In addition, the antenna angles are brought to the radar signal processor over a high-speed parallel interface (16 bits for AZ and EL) or a standard TCP/IP network connection so that the data collected by the processor are properly tagged with the correct angle.

Some radar manufacturers supply extensive BITE (built-in test equipment). The BITE unit is interfaced through the RCP. IRIS provides the Bitex utility for monitoring the BITE parameters. The RCP test and control utility, called Antenna, is also provided as part of IRIS. Refer to the *IRIS Utilities Manual*.

1.2.4 Color Printer and Output File Formats

An optional color printer serves as a hardcopy products output device. The printer is also used for printing tape/optical disk inventories and other system maintenance and documentation functions. Color postscript printers are supported.

The output files can be formatted as IRIS Native, TIFF with optimal compression, BMP, GIF, JPG, Postscript or Compressed serial link format. That makes it easy to use radar images in external applications such as web pages.

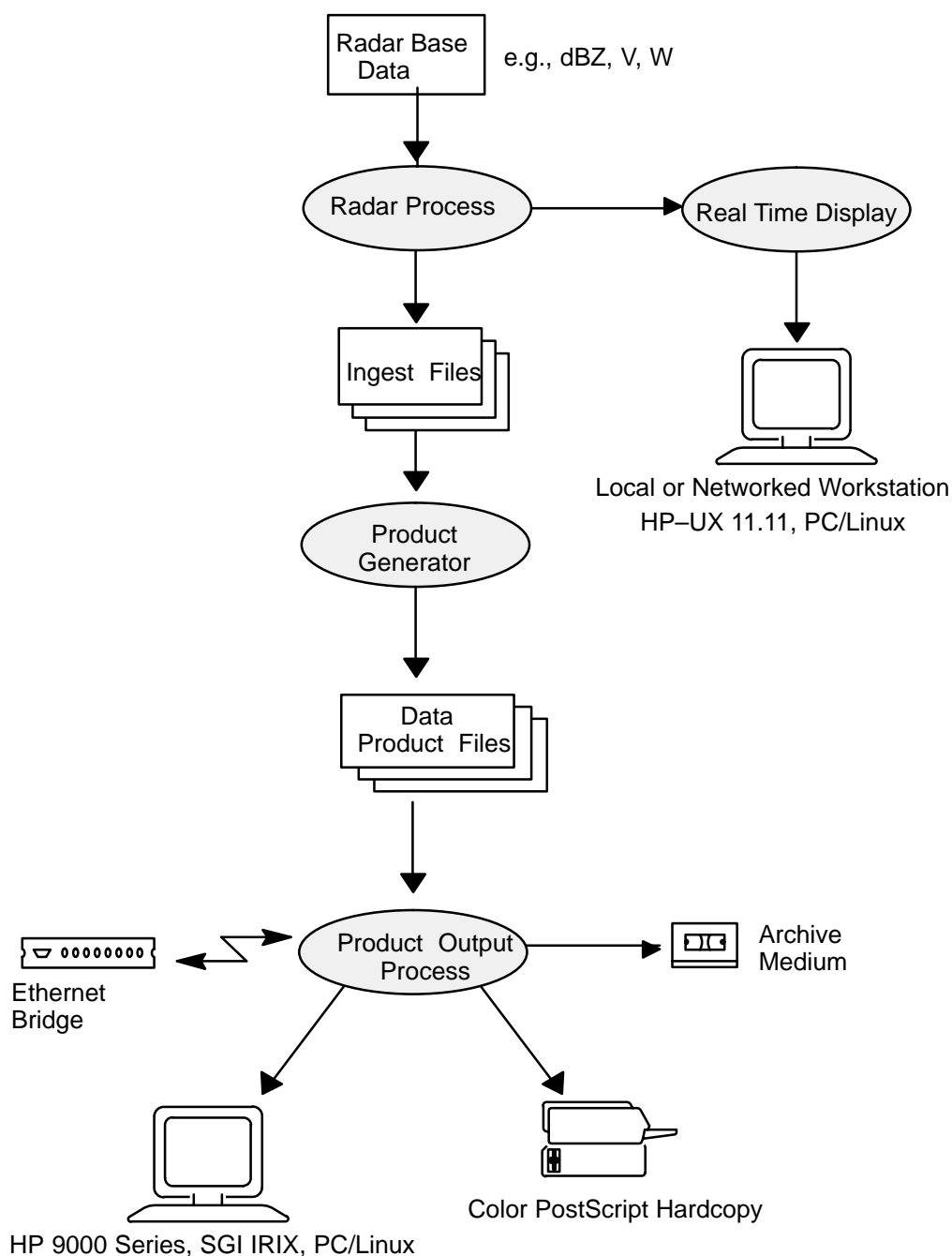
1.2.5 Tape Drive or Optical Storage

Typically a system is equipped with a CD-ROM, which is used for IRIS installation. Archive/retrieve is supported on DAT tape, MO Disk, DVD+RW drivers, and large disk archives (LDA's) implemented on a local or remote hard disk.

1.3 IRIS Architecture

IRIS is made up of a number of processes to convert radar data into output formats for display, printing, or storing on tape or disk, as shown in Figure 1–3.

Figure 1–3: IRIS Processes



Radar Process

The signal processor sends base data to the IRIS Radar Ingest process. IRIS can handle any of the following kinds of radar data:

| | |
|--------------|--|
| V | Linear channel Doppler mean velocity. |
| W | Linear channel Doppler spectrum width. |
| Z | Log channel reflectivity corrected for clutter. |
| T | Total log channel reflectivity (not clutter corrected). |
| ZDR | Differential reflectivity available with ZDR option package (polarization radars). |
| KDP | Differential phase available with RVP7 processor |
| RHOHV | Dual polarization correlation magnitude |

The Radar Process controls the signal processor and RCP “TASK” for the data acquisition. A TASK is a set of instructions to perform a scan, such as a single RHI scan or a PPI volume scan at multiple elevation angles. The antenna scanning, signal processor configuration, PRF, pulse width, and so on, make up the parameters of the TASK, or “TASK configuration.”

IRIS can execute only one TASK at a time, but up to eight separately defined TASKS can be scheduled to run at different times, and up to three TASKS can be linked together to form a single hybrid TASK.

Thus, there are two aspects to running the radar:

- Defining the TASK configuration
- Defining the TASK schedule

IRIS provides interactive menus for performing these operations and allows you to save the results on disk so that TASK configurations and schedules can be recalled easily. IRIS can store several volume scans of raw ingest data, depending on the size of the disk that is available.

Ingest Process

The signal processor sends base data to the IRIS Ingest process.

The Ingest process controls the signal processor and RCP “TASK” for the data acquisition. A TASK is a set of instructions to perform a scan, such as a single RHI scan or a PPI volume scan at multiple elevation angles. The antenna scanning, signal processor configuration, PRF, pulse width, and so on, make up the parameters of the TASK, or “TASK configuration.”

IRIS can execute only one TASK at a time, but up to eight separately defined TASKS can be scheduled to run at different times, and up to three TASKS can be linked together to form a single hybrid TASK.

Thus, there are two aspects to running the radar, performed using the corresponding IRIS menus

- Defining the TASK configuration
- Defining the TASK schedule

Real Time Display Output Process

The Ingest data from the signal processor are also split to the real time display output process which constructs ray-by-ray packets (e.g., 1 degree) that are broadcast over the network using the UDP socket approach. Any networked workstations that are running the real time display receiver software (included with all IRIS systems) can view the radar scan in an X-Window. The real time display can also be viewed on the local workstation where the data are collected. The broadcast approach allows the simultaneous use of multiple-networked real time displays without burdening the network.

Product Generator Process

Ingest files serve as the starting point for the IRIS products. They are the input to the Product Generator, which creates meaningful representations of the raw data, called product files. The complete list of products that IRIS can generate is given in Product & Display manual.

Like TASKS, products are configured and scheduled. For example, to produce a CAPPI picture product:

- The product configuration defines the required height of the CAPPI surface, the maximum range to display, the parameter to display, the pixel resolution of the display, and the default color assignment. The configuration also defines the TASK that provides the ingest file for computing the CAPPI product.
- The product schedule defines how often IRIS should generate the product, i.e., every time the associated TASK runs, only the next time the TASK runs, or only for selected ingest files.

IRIS provides menus to perform these operations, and like TASKS, these products can be saved to disk and recalled for later for product generation.

There is a separate Product Generator process for each type of product. The Product Generator takes the ingest file for the TASK, computes the product, then stores the result in a product file. Results from one product file may also be required to compute another product.

Product Output Process

Product files can be requested by the various IRIS users or sent automatically to any of the following output devices:

- Interactive X-Windows graphics displays.
- Disk files on networked workstations, where the products are available for local display and manipulation. Many different formats are supported.
- Tape drives or optical disk drives for data recording (archiving).
- Printers for hardcopy.
- Serial data link.

In each case, a Product Output process takes the product file, reformats and/or compresses it as required by the device, and transmits it over the appropriate interface. Custom reformatting is made easy by the use of IRIS output “pipes”. These are open source software routines that can be linked to a network output.

IRIS can record to tape or optical disk and retrieve any product file. This means that retrieved products are available for display as if they were generated in the normal way. The RAW product allows ingest files to be restored so that they are available for subsequent product generation.

IRIS Quick Look Windows

IRIS products can be displayed in a workstation window. Up to nine display windows can be configured on an IRIS system.

Watchdog Process

By design, the disk space on an active IRIS system is nearly always full so that the maximum amount of information is available to users. To make room for new ingest and product files, a Watchdog process automatically deletes files according to their age and whether there is a request to use them in the future.

Network Process

Because of its general architecture, IRIS is well suited for operating in a network environment. For example, the Product Generation process can run on a different computer on the network to free the primary IRIS host to control the radar (Radar process) and handle user interactions (Product Output process). Remote control and monitoring of IRIS on an X-terminal or other workstation is an integral part of the design because the IRIS menus provide complete access to all aspects of the radar control. This software architecture also makes it easy to support new output devices and products for new applications.

You send products to the display in either of the following ways:

- From the Product Output menu, send products according to a product output schedule.
- From the Quick Look Window directly via interactive buttons.

1.4 IRIS Menus

IRIS menus give operators, observers, and remote display users flexibility in determining how IRIS collects, processes, and displays radar data. They provide an easy mechanism for creating and saving standard operating modes for “hands-off” operation.

In many cases, the IRIS menus permit multi-user access, provided there is no conflict. That is, two users cannot configure the same file or try to use the same device.

Some menus can be controlled only by operators. However, even if you are not allowed to control a menu, IRIS lets you view it. For example, an observer may view the TASK Scheduler menu to see what TASKS are currently scheduled to run, but cannot modify it.

Table 1–1 lists the IRIS menus and the users who are authorized to access them.

Table 1–1: Access to IRIS Menus

| Menu | Users | Description |
|-----------------------|-------------------------|--|
| IRIS Menu Bar | All Users | For selecting other menus and exiting from IRIS. |
| Radar Status | Operators Observers* | For monitoring and controlling the hardware components and the IRIS configuration. |
| TASK Configuration | All Users | For configuring the details of a radar and signal processing TASK, such as a volume scan. This menu may be entered either from the IRIS menu bar or from the TASK Scheduler. |
| TASK Scheduler | Operators | For scheduling the execution of TASKS. Schedules may be repetitive (for example, every 15 minutes), or a single execution. |
| Product Configuration | All Users | For specifying the TASK configuration — the TASK that provides the ingest files, the type of product, and the type of output (text, picture, or data). |
| Product Scheduler | Operators Observers* | For scheduling products to run. |
| Product Output | All Users | For showing what products are available on disk and selecting products for transmission to workstations. Operators can transmit products and overlays to any workstation, printer, or tape/optical disk drive. |
| Quick Look | All Users | Designed especially for forecasters. This menu provides easy access to IRIS data for forecasting applications. |

* Observers may view the contents of the menu only.

Table 1–1: Access to IRIS Menus (cont.)

| Menu | Users | Description |
|-----------------|-------------------------|--|
| Real Time Disp | All Users | Designed especially for forecasters and operators to view the instantaneous PPI scan of the radar in real time. |
| Archive Menu | Operators | For controlling the IRIS tape and/or optical disk operations, including recording and retrieving. This menu also displays archive logs that list the contents of a device. |
| Projection Menu | Operators | For configuring custom map projections such as Mercator or azimuthal equidistant with different radar positions (e.g., not centered). |
| Ingest Summary | Operators Observers* | For listing the ingest files on disk, for manually deleting files, or setting the Keep flag so that files are not deleted by the Watchdog process. |
| Messages | All Users | For viewing the messages that have been sent to the user during an IRIS session. |
| Overlay Menu | All Users | For choosing which overlay to use when viewing data from a particular radar site. |

* Observers may view the contents of the menu only.

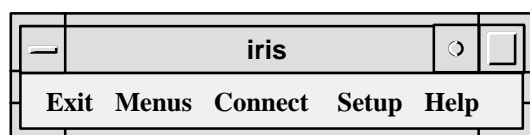
Figure 1–4 shows how the IRIS menus fit into the IRIS architecture.

1.4.1 Starting IRIS Client (Menus)

IRIS menus can run from the same or a different system than the host, as long as they are connected to the host over a network connection. To start the IRIS menus, click the Conductor icon in IRISnet, or enter the following command from the operating system prompt:

```
$ iris
```

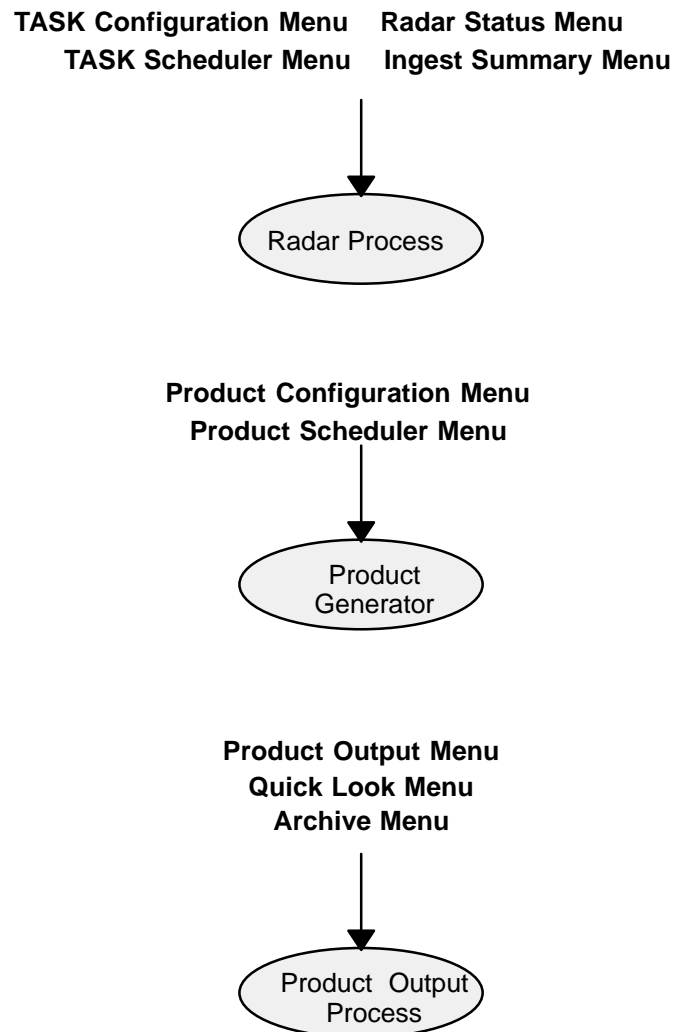
After a short pause, the IRIS menu bar appears:



1.4.2 To exit from the IRIS menus

Choose **Exit**→**Exit** from the menu bar.

Figure 1–4: IRIS Menus in the IRIS Architecture



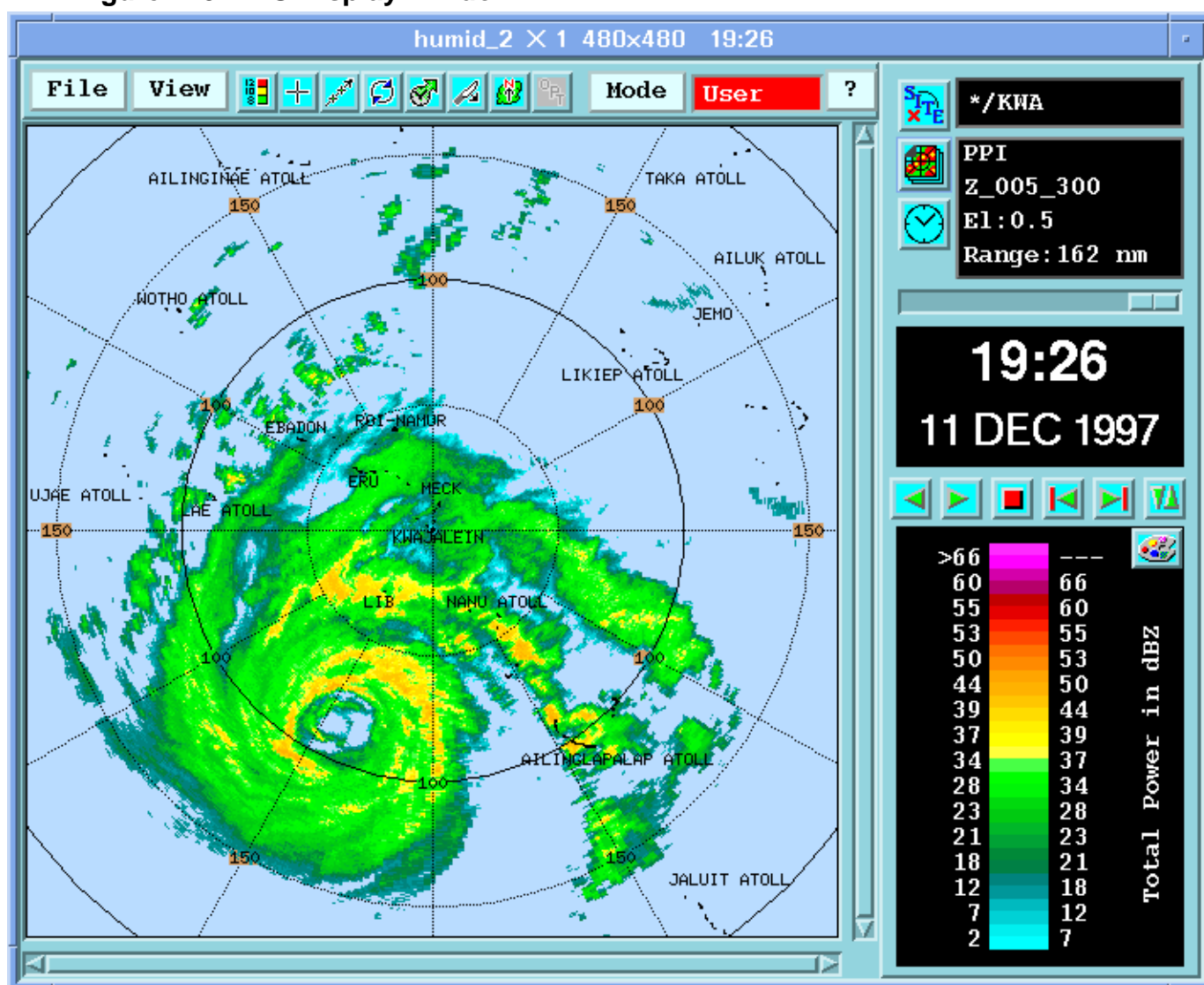
1.5 IRIS Quick Look Windows

IRIS products can be displayed in a workstation window. Display windows are configured with the **setup** utility. (See the *IRIS Utilities Manual*.) Up to nine display windows can be configured on an IRIS system. **Figure 1–5** shows an example of a display window. For details on window features see the *IRIS Display Manual*.

You send products to the display in either of the following ways:

- From the Product Output menu, send products according to a product output schedule.
- From the Quick Look Window directly via interactive buttons.

Figure 1–5: IRIS Display Window



1.6 Starting the IRIS Client/Server Model

IRIS runs in two parts:

- The IRIS host runs the processes, the radar and signal processor, product generator and output processes. It collects data and creates ingest file as defined by TASKS and schedules. It acts as a server for IRIS clients.
- The IRIS client runs the menus- the user interface for viewing products and managing the host. The client is run locally on the user's computer and connects to an IRIS server somewhere on the network- perhaps even on the same computer. The client menus let users define products and TASKS, establish schedules, and monitor the host's activities.

There is always at least one host running on an IRIS system, and many clients can connect to it. The advantage of this architecture is that the client/server communication is much more efficient in terms of bandwidth than the approach of simply exporting an X Window. This allows the menus to be responsive even when the network speed is limited.

1.6.1 Booting the Host Computer

Typically, the host computer is left running 24 hours a day. If it is turned off, or if there is a power failure, the system must be rebooted. Booting the computer, getting it running when power is first applied, is the responsibility of the system manager or an operator designed by the system manager.

Most systems, and unattended systems, are configured to boot up automatically when the power is turned on. This can take several minutes to complete. If your system should boot up automatically but does not, check that the switch on the back of the CPU is set for auto-booting and that any required Ethernet terminators are properly installed. Refer to the manufacturer's documentation for more information.

If your system is not configured to boot up automatically, you must perform a manual boot-up. Again, refer to the manufacturer's documentation for information on booting up the system manually.

NOTE: you should never switch off a running UNIX or LINUX computer from the power switch. Instead

- if you are logged in as operator or observer, logout (EXIT X windows)
- login as **root**
- unmount tapes and floppies if necessary
- shut the computer safely down by typing the command

LINUX SYSTEMS:

```
# shutdown -h now
```

HP-UX SYSTEMS:

```
# reboot -h -t now
```

IRIX SYSTEMS:

```
# halt -p
```

1.6.2 Logging on to the Host Computer

All users must have a unique username and password assigned by the system manager.

Initially, all systems configured at the factory by SIGMET have the following default usernames and passwords:

| Username | Password |
|----------|----------|
| root | XXXXXXXX |
| operator | XXXXXX |
| observer | XXXXXX |

These are subject to change by the system manager. To log on to the host, enter your username and password. After a short pause, the system should display its operating system prompt.

1.6.3 Starting the IRIS Host

Some systems are configured to start IRIS automatically on boot-up. If your system is not configured in this way, you must start IRIS. The IRIS start-up procedure can be performed by any operator; it does not have to be done by a system manager.

Check that power is applied to the radar and all IRIS devices. While this is not essential to starting IRIS, it must be done at some point.

IRIS Host can be started remotely or locally using the **irisnet** utility (see **Section 3.1**) In **irisnet**, the color of the icon for each computer indicates whether IRIS is already running on that node: green for running, yellow for not-running and red for not accessible over the network. Double clicking an **irisnet** icon of any host computer, gives a menu where the icon for starting IRIS (a green traffic light) can be double-clicked.

Alternatively, to start IRIS from the operating system prompt, type:

```
$ siris
```

Siris starts various processes and initializes several files. At each step, it displays a message. When start-up is complete, the operating system prompt reappears, and IRIS is ready to use.



If you are having any trouble with your system, be sure to read the siris startup messages since these can often tell you what the problem may be.

As part of the start-up procedure, **siris** checks the configuration of the setup files. If an error is detected it is signaled. Refer to the *IRIS Utilities Manual* section on the setup utility for information on resolving these errors.



Caution: When IRIS starts up, it tries to execute default operating TASKS. If there is a danger to personnel from antenna motion or radiation, your radar console switch should be set in the “Local” position, so that IRIS cannot take control. You can also configure a TASK named DEFAULT that does not start the radar antenna and transmitter (see Chapter NO TAG).

1.6.4 Shutting Down the IRIS Host

Shutting down the IRIS host is an operator responsibility. Typically, IRIS is stopped only for maintenance reasons, such as before halting or rebooting the computer. Otherwise, it is best to leave IRIS running at all times.

The IRIS Host can be stopped remotely or locally using the IRISNet Utility (see **Section 3.1**) Double clicking an icon of any host computer, gives a menu where the icon for quit IRIS, *qiris* (a red traffic light) can be double-clicked.

Alternatively, to shut down IRIS from the operating system prompt, type:

```
$ qiris
```

Qiris prompts to be sure this is what you want to do, then it goes through a shutdown procedure to leave the radar and antenna in a safe, non-operating state. IRIS clients are disconnected.