

E. IRIS TDWR Features

E.1 Overview

E.1.1 Items provided with the IRIS/TDWR Option

The optional IRIS/SHEAR package includes various features for terminal Doppler weather radar applications. The features and their associated documentation are summarized below:

- **SHEAR Product** *IRIS Users Manual* Section 3.5
The WARN product run on a radial SHEAR product is used for microburst detection.
- **SLINE Product** *IRIS Users Manual* Section 3.6
Detects wind shifts associated with gust fronts and cold fronts. Can use radial, azimuthal or combined radial and azimuthal shear.
- **Ribbon Display** This appendix Section E.3
Ribbon display terminals (RBDT's) are large format text-only displays that are used to display and signal alerts to controllers. IRIS supports US FAA-style Dale RBDT's which are serial line hardware devices and Virtual RBDT's (vribbons) which are X-Window displays.
- **TDWR/LLWAS Integrator** This appendix Section E.4
Uses the US FAA algorithm to integrate information from IRIS shear warning products and LLWAS (low-level wind shear alert system) to generate TDWR products for output to standard US FAA-style ribbon displays. Note that an LLWAS system is not required.
- **Runway Utility** This appendix Section E.4.4
Graphical utility for selecting the active runways that are in use. The information is used by the TDWR/LLWAS Integrator to select for which runway corridors alerts are issued to the RBDT's.

These features, combined with all the standard features of IRIS, provide controllers with timely, concise information concerning wind shear and other weather phenomena that can affect air terminal operations.

The TDWR used by the US FAA is based on technology circa 1985. Since this time, computer speeds have increased dramatically. There have also been changes, in algorithms, networking standards and user interface. The goal of the IRIS/TDWR is to take the best elements of the TDWR designs and implement them in the context of today's technology.

SIGMET does not warrant that the IRIS/TDWR option will function in accordance with US FAA Specifications.

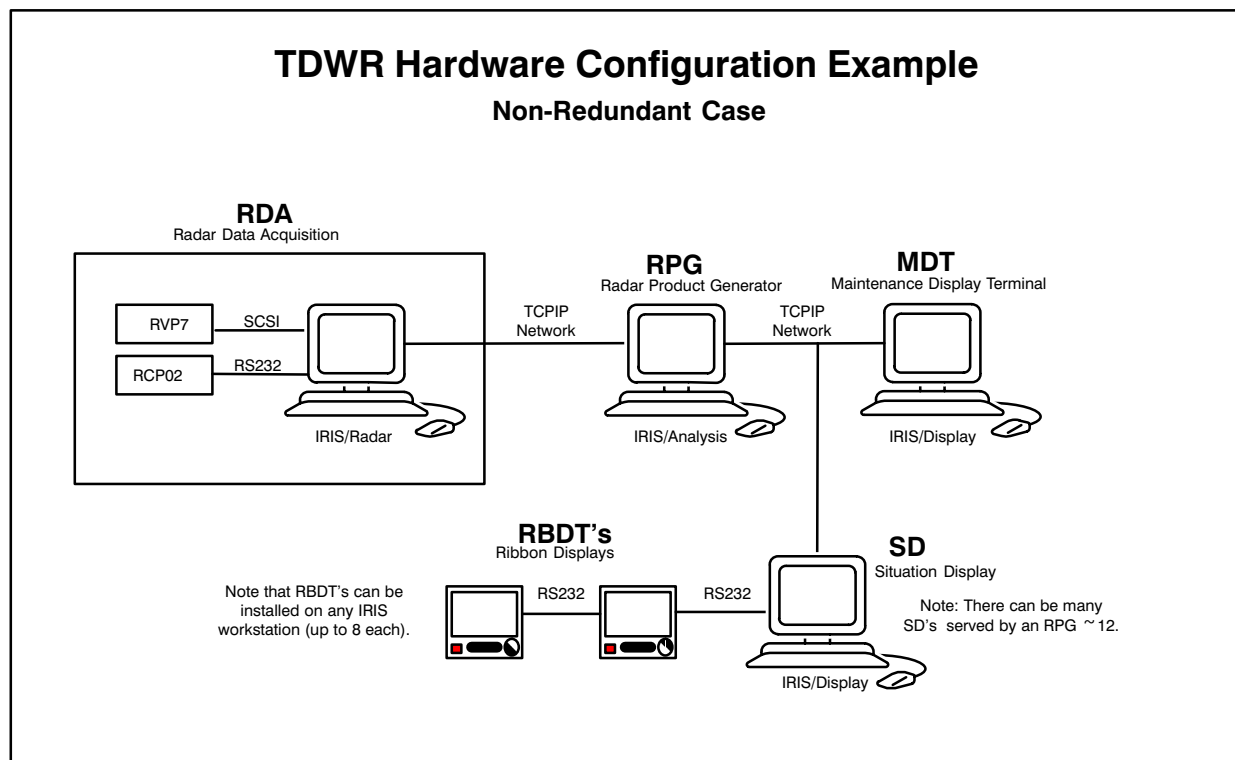
E.1.2 IRIS/TDWR Terminology

Below is a summary of US FAA TDWR terminology and how it matches-up to IRIS terminology:

- **Radar Data Acquisition System (RDA)**- this is the system that collects data. In IRIS this would consist of the signal processor, radar control processor and a workstation running IRIS/Radar software.
- **Radar Products Generator (RPG)**- in TDWR this is a separate computer that takes in Base Data from the RDA and generates products. The IRIS analog would be a workstation running IRIS/Analysis receiving data from another workstation running IRIS/Radar. In IRIS the RDA and RPG functions can be combined.
- **Maintenance Display Terminal (MDT)**- Used for control and monitoring of the TDWR system. Since IRIS is a networked client-server system, the concept of a dedicated “terminal” for this function does not really apply, since any workstation on the network can provide this function. For management purposes, it is sometimes useful to have an IRIS/Display workstation that is dedicated to the MDT task.
- **Ribbon Display (RBDT)**- this is a text only display intended for controllers. It connects to an IRIS Workstation via a serial line.
- **Situation Display (SD)**- a simplified weather display showing oval shapes to depict microbursts and current and forecast wind shear line positions. In IRIS, this is accomplished by the simultaneous display of WARN and SLINE products.
- **Arena**- in IRIS this is called a protected area. For example runway 33LA_1MF signifies a box (typically 1 miles square) that is centered 1 nautical mile from the approaching end (south end) of runway 33 (nominally approached on a heading of 330 degrees).
- **Corridor**- Each runway has two corridors, an approach corridor and a departure corridor.
- **Base Data**- the basic dBZ, V and W data. In IRIS the compressed version is the RAW product. The un-compressed version is called Ingest Data.
- **Wind Shear Alert (WSA)**- alert of a shear line or gust front based on the SLINE (shear line) product, or a weak microburst based on the WARN product run on radial shear.
- **Microburst Alert (MBA)**- alert of a strong microburst. In IRIS these are based on the WARN product run on a radial SHEAR product.
- **Low Level Wind Shear Alert System (LLWAS)**- based on anemometers that are positioned around the air terminal. LLWAS is not available at all sites. Where it is available, it provides backup to the TDWR in cases where the radar coverage is obscured, or there are no scattering targets.

E.1.3 IRIS/TDWR Hardware Configuration Example

SIGMET supports both single and dual-redundant hardware configurations. Because of the network communications features in IRIS there are many possible hardware configurations that allow different tasks to be performed by various workstations. The example below is for a non-redundant system.



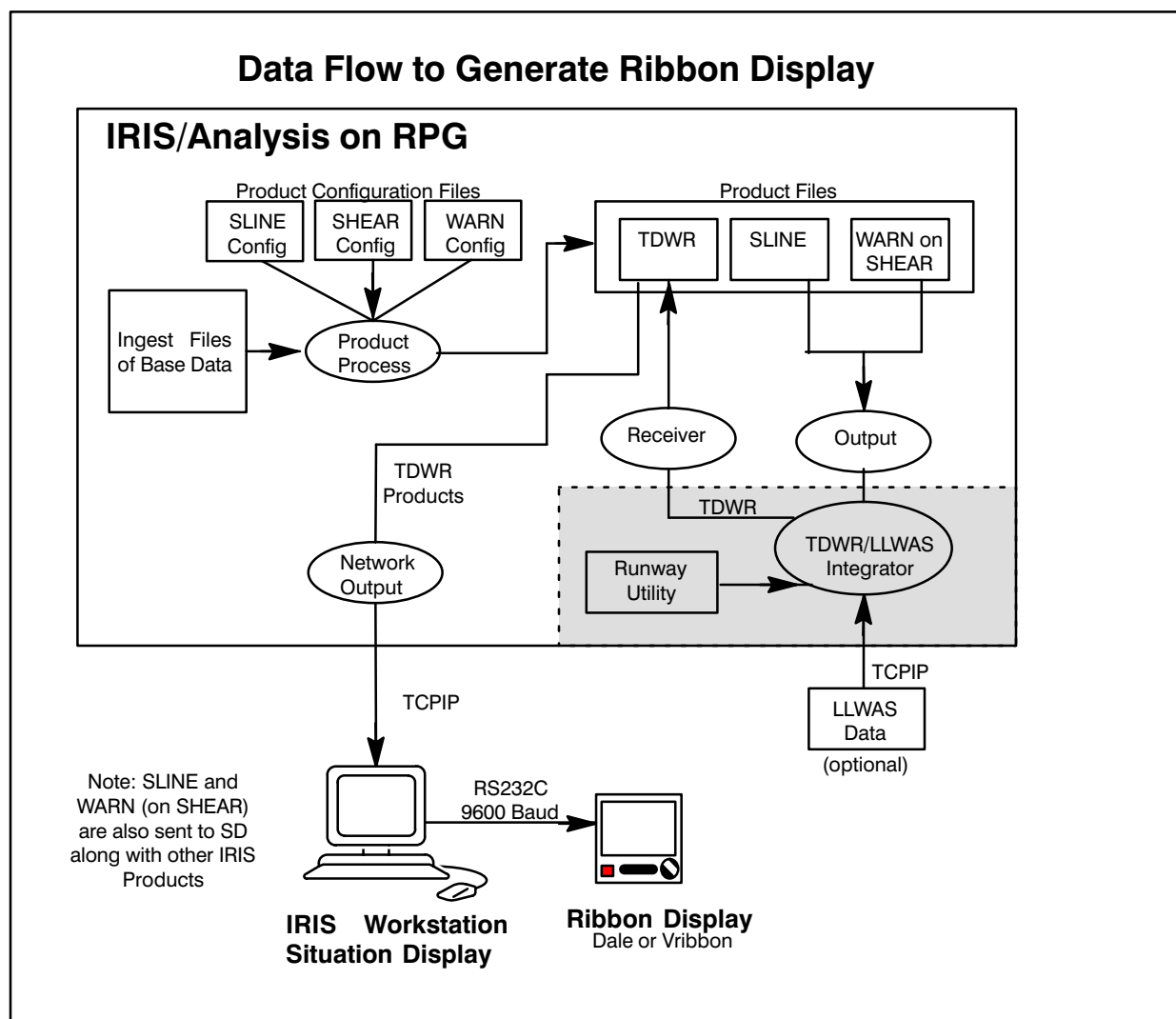
With the IRIS architecture, the RPG and MDT functions could be combined into the RDA workstation. Reducing the amount of hardware increases the system reliability and reduces maintenance. The RDA workstation also has all the features of an SD.

For redundant systems, there are two RDA's and two RPG's. The RDA's have dual network interfaces and the active one outputs base data to both RPG's. This means that all the products are actually made twice. Each SD is configured with three network interfaces — one for each RPG and a separate one for network output to the SD's. Each SD is equipped with two network interfaces — one for each RPG. Thus each SD receives two versions of each product — one from each SD. If one RPG or network fails, the SD's will continue to receive products from the other one.

E.1.4 Data Flow for Ribbon Display Generation

The primary function of the TDWR processing is to output ribbon display messages to controllers (accompanied by audio warning tone). In addition, the standard IRIS output and display features are used to construct images for the Situation Displays (SD's), i.e., simplified displays showing runway warning areas (arenas), alert centroids and shear lines with forecast positions. Since the SD's are normal IRIS displays, any other IRIS product can be displayed as well.

Ribbon displays are generated whenever the local IRIS (the IRIS where the ribbon display is connected) receives a special TDWR product. The data flow to generate these TDWR products is shown below:



The normal IRIS product generation makes SLINE and WARN products for radial shear (microburst warnings). These products will have all possible protected areas turned on, even for inactive runways. The results are sent to a separate TDWR/LLWAS Integrator. The Integrator takes data from LLWAS (if available) and configuration information on the current active runways from the runway utility. The output back to IRIS is a TDWR product that is filtered so that only the information required by the ribbon display is present. The integration algorithm is the FAA/MIT Lincoln Lab algorithm that was developed for the U.S. FAA TDWR.

Usually both IRIS and the Integrator run on the RPG, although it is possible to run the TDWR/LLWAS Integrator on an SD. This would, however, lead to configuration chaos since there are likely to be many SD's.

The RPG then outputs the TDWR product to the SD's and when it is received, it is automatically formatted into a ribbon display message and sent out the SD serial line. The process that outputs the products to the RBDT's has an additional configurable filter, i.e., the controller can specify which corridors will be displayed on an SD. The **ribsetup** utility is used to configure this.

E.1.5 IRIS/TDWR Configuration Summary

The remainder of this appendix covers the theory, installation, configuration and use of the various TDWR components. For convenience, the installation steps are summarized here:

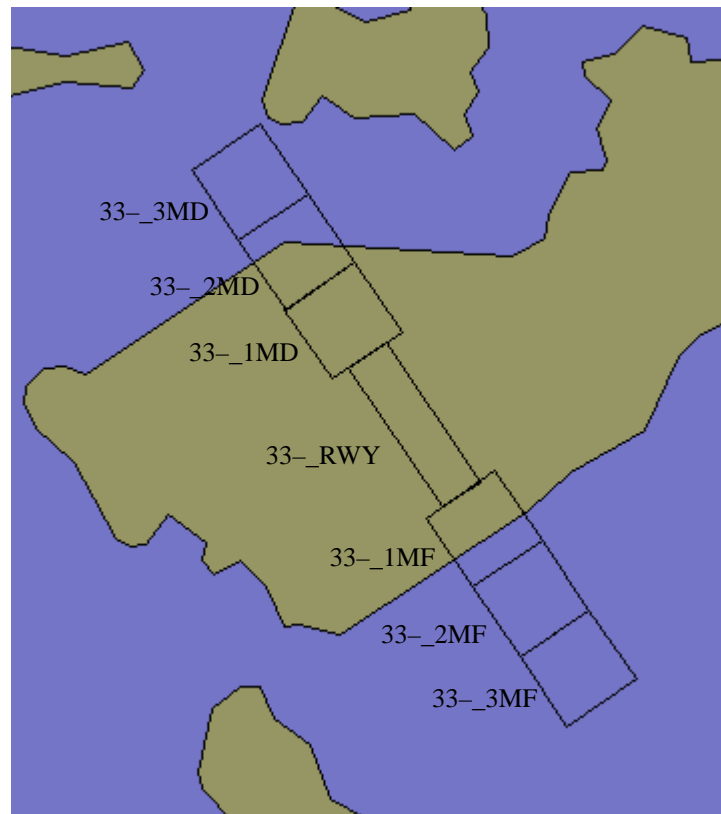
- Configure the IRIS for TDWR operation.
 - Section E.2.1 Configure the runway arenas (protected areas)
 - Section E.2.2 Configure the scan TASKS and the SLINE and SHEAR products
 - Section E.2.3 Configure the outputs to the Integrator and the SD's.
- Install and configure the Ribbon Displays.
 - Section E.3 Hardware installation
 - Section E.3.6 **Ribsetup** utility
- Section E.4 Configure the TDWR/LLWAS Integrator (runways.conf).
- Section E.4.4 Use the **runways** utility to set the runway direction.

E.2 IRIS Preparation

The preparation of the IRIS system involves setting-up the protected areas, scan strategy, product generation and output for TDWR operation.

E.2.1 Protected Area Configuration (Arenas)

Protected areas are configured in the IRIS setup/product utility. An example of protected areas configured as arenas for a TDWR system is shown below. This section describes how to configure these areas.



Arena Naming Convention

A special naming convention is used to designate runway corridors and protected areas (also called “arenas”). An example is shown in the figure above.

The naming convention for runways is as follows:

- The first two digits are the runway name, also referred to as the “corridor” name. In the example, this is “33”. There is no need to make corresponding names for the reverse direction (runway 15). This will be done automatically. SIGMET recommends that you use the convention of naming the “north bound” direction for a corridor.

- The next position is used if there is a left and right runway. For example, use 33R and 33L to indicate left and right runways. If there is only a single runway, then use a dash as was done in the example, i.e., 33-. Note, if the left and right runways are within approximately 500 m of each other, then it is easier to designate a single corridor for alert purposes rather than have two separate corridors that are almost completely overlapped.
- The next field is an underscore character which serves as a separator.
- The last 3 digits are used to specify the “arena”. For example, “1MF” is used to specify a protected area that extends from the end of the runway to 1 mile from the end of the runway. It is recommended that you use the text RWY to specify the runway itself.

Once you have decided the names for all the runways and arenas, then you should construct the geometry of the protected areas, i.e., the size and orientation information that is required in the IRIS Setup/Product utility. Refer to the *IRIS Utilities Manual* for details. It is tricky to get the areas correct so to help you:



SIGMET provides an EXCEL spreadsheet that makes it easy to configure runway protected areas. Please download it from our website www.sigmet.com or email support@sigmet.com for a free copy.

After you have created your protected areas you can test them with the **overlay** utility. This requires that you have already configured the overlay for your system. Refer to the chapter on **overlay** in the *IRIS Utilities Manual*. To see your protected areas on top of your overlay select the *Options* menu and press the button labelled “Protected”.

The display will show you the protected areas. Zoom in as needed to see them. The areas will not be labeled. Verify that all the areas are present in the correct locations and that all of the edges are properly aligned. If not, quit **overlay** and then go back to IRIS setup/product to edit and save the protected area information. Retest with **overlay** to see if you got it right.

E.2.2 IRIS TASK and Product Configuration

The configuration of scan TASKS and the SLINE and SHEAR products required for TDWR operation depends on the specific requirements of the user and the constraints of the site. Therefore each site tends to be different. For example, some customers may require that a complete volume scan information be collected during TDWR operation (to provide general weather monitoring) while others may want to have the scan dedicated to low-level wind shear detection. Most installations will configure the system to switch automatically from a weather monitoring mode to a hazard monitoring mode, whenever there is severe weather near the terminal.

The example configuration provided in Section B.3 of this manual can be used as a starting point for operation. This example will need to be adjusted to the specific requirements of your site. This is typically done when your system is installed.

E.2.3 IRIS Product Output Configuration

The special IRIS product output configuration for the TDWR consists of:

- Output of TDWR products to the SD's (IRIS/Display Workstations with hardware and/or virtual ribbon displays).
- Output of SHEAR and SLINE products to the TDWR/LLWAS Integrator.

Both of these output configurations are made on the system where the TDWR/IRIS Integrator is running. This is typically an IRIS/Analysis Workstation functioning as an RPG (radar product generator). In the examples below, this node is called "cyclone".

Configuring Output to the SD's

The first step is to set-up the network output devices for the SD's. This is done in the usual manner in IRIS setup/output. An example is shown below for a network output to a workstation that is called SD1. The standard IRIS target directory and TCPIP notification port are used in the example.

The screenshot shows a window titled "IRIS Output Device Setups, cyclone". Inside, there is a "File" menu and a "Help" button. The main area is labeled "Output Device #5" and contains the following fields:

Device type	Network
Unit number	3
Menu alias	SD1
File format	IRIS (Def)
Filename format	Native
Data format	<input type="checkbox"/> Normal
Notification scheme	TCPIP
Target directory	/usr/iris_data/product/
Copy scheme	RCP
Notification port number	i 30725
Recipient node name	SD1

Finally, configure the IRIS Product Output Menu to make automatic output of TDWR products to the SD's (refer to Section 6.3 of this manual).

Configuring Output to the TDWR/LLWAS Integrator

Next use IRIS setup/output to configure the output to the Integrator. See the example below. Use the “Short” file name format. Since the Integrator will be running on the same machine use “Copy” rather than “RCP” (remote copy). The notification port must match what is configured for the Integrator in the runways.conf file (section E.4.2). The recommended port is 30726 as shown in the example.

The screenshot shows a window titled "IRIS Output Device Setups, cyclone". It has a menu bar with "File" and "Help". Below the menu bar is a section titled "Output Device #4" with a "Help" button. The configuration fields are as follows:

Field	Value
Device type	Network
Unit number	2
Menu alias	Integrator
File format	IRIS (Def)
Filename format	Short
Data format	<input type="checkbox"/> Normal
Notification scheme	TCPIP
Target directory	/usr/iris_data/tdwr/
Copy scheme	Copy
Notification port number	i 30726
Recipient node name	cyclone

Finally, configure the IRIS Product Output Menu to make automatic output of SHEAR and SLINE products to the Integrator (refer to Section 6.3 of this manual).

E.3 Ribbon Displays

E.3.1 What is a Ribbon Display?

A busy ATC controller does not have time to look at color situation displays and interpret them. Ribbon displays are alphanumeric displays (connected to the Situation Displays) that provide ATC personnel with concise information on the status of various runway corridors with regard to wind shear and microburst events. The display shows simple text messages of the form:

32LA MBA 3MF 40K– 180 14

32LD 190 15

33LA WSA RWY 25K+ 190 17

33LD WSA RWY 25K+ 160 14

The interpretation of these messages is as follows:

- The first line informs the controller of a microburst alert for runway 32 left at 3miles final approach. A 40 knot loss of airspeed can be expected. At the end of the line is the measured surface wind (direction and speed in knots) at the threshold end of the runway or from some other point on the field (depending on the availability of wind information from an LLWAS or other source).
- The second line shows the normal display with no warning message. Only the wind is displayed.
- The third and fourth lines show a wind shear alert (shear line) for runway 33L (approach and departure) with an expected 25 knot gain. The threshold winds are displayed at the end of each line.

In addition to the text messages an audio alert tone is sounded whenever an alert is issued. The controller acknowledges the alert tone by pushing a button on the front of the ribbon display.

E.3.2 Types of Ribbon Displays Supported by IRIS

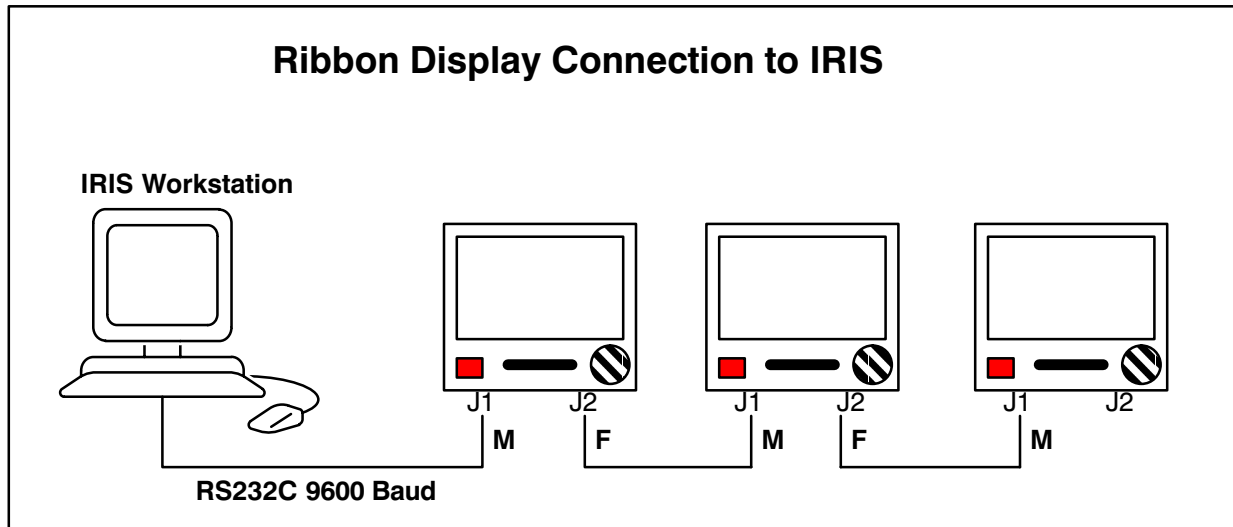
IRIS Supports two types of ribbon displays:

- Dale Electronics, Inc. Model ADP–250M045 (–1 for 220V) Plasma Display Monitor/Alarm System. This is used by the US FAA. Because of its brightness it is well-suited for tower cab environments which have high background light.
- IRIS Virtual Ribbon Displays. This is an X-Window display which can be put on a workstation or PC running X-Windows.

The IRIS Workstation must be licensed for ribbon display support.

E.3.3 Dale Ribbon Display Hardware Installation

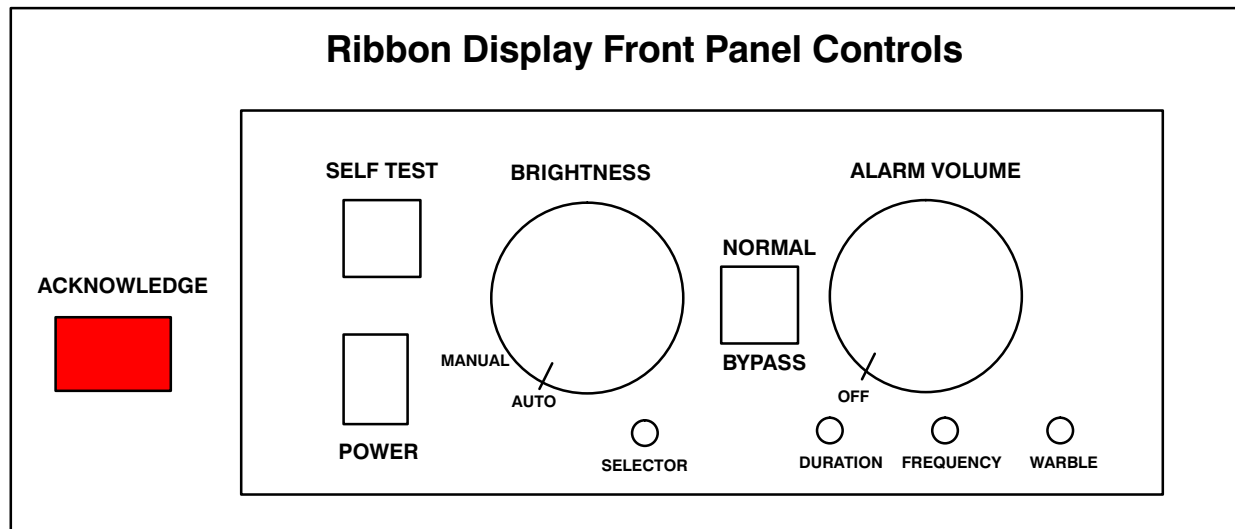
Up to 8 Dale ribbon displays can be “daisy-chained” to an IRIS workstation as shown in the figure. The M and F notation refers to the cable end (DB25M or DB25F).



The pin assignments for the connectors are as follows:

Pin	J2	J1	Signal
	1	1	GND (shield)
	3	2	Receive Data
	2	3	Transmit Data
	7	7	GND

E.3.4 Dale Ribbon Display General Use



The hinged front panel drops down to access the local controls. The controls area is illuminated when the door is open. The features are summarized below.

Self Test

Holding in the SELF TEST push button writes the character set to the display. The monitor's I.D. number, model number, and software version are also shown on the last line of the self test screen. At this time the selector switch can be adjusted to change the I.D. number if required. The audio alarm is also activated which allows the volume and warble to be adjusted to the user's preference. If data is sent to the monitor while SELF TEST is depressed, the monitor will set D6 and D7 (of the status byte) high when the button is released indicating that data sent to the unit was not captured and that the screen should be regenerated.

Brightness

The display brightness can be adjusted manually with the BRIGHTNESS control. Brightness is increased with clockwise rotation. When the control is rotated to its extreme counter-clockwise position (past a switch detent) the brightness is controlled automatically according to the amount of ambient light in the room.

Normal/Bypass

With the switch in the "NORMAL" position, communication between the monitor, host, and other peripherals is enabled. With the switch in the "BYPASS" position, the RS-232D signals are routed around the monitor. This is a hardware switch which completely isolates the monitor's I/O circuitry when in the "BYPASS" position.

Selector

The monitor's identification number can be set from 0-7 via the recessed switch. To set the identification number, push and hold the SELF TEST button, and adjust the SELECTOR control until the desired number is displayed on the screen. Note: There are three positions that display zero. All work as I.D. #0.

Alarm Controls and Adjustments

The audible alarm is two tones that are alternately turned on and off to create a "warble" effect. The parameters of the warble can be altered per the users preference with the DURATION, FREQUENCY, and WARBLE adjustments. (These adjustments are recessed to prevent unintended changes.)

Volume

The audible alarm loudness can be adjusted from 60 dBa to 85 dBa with the VOLUME control. Turning the control fully counter clockwise disables the alarm speaker output. Loudness is increased with clockwise rotation and decreased with counter clockwise rotation.

Duration

The DURATION adjustment varies the on/off time (duty cycle) of the two tones.

Frequency

The FREQUENCY adjustment raises or lowers the frequency of the two warble tones.

Warble

The WARBLE adjustment varies the rate at which the two tones are alternated.

Acknowledge

When the host computer sends an alarm, the monitor will activate the audible alarm and illuminate the ACKNOWLEDGE push-switch. Pushing the ACKNOWLEDGE switch signals IRIS that the alarm was acknowledged and silences the alarm.

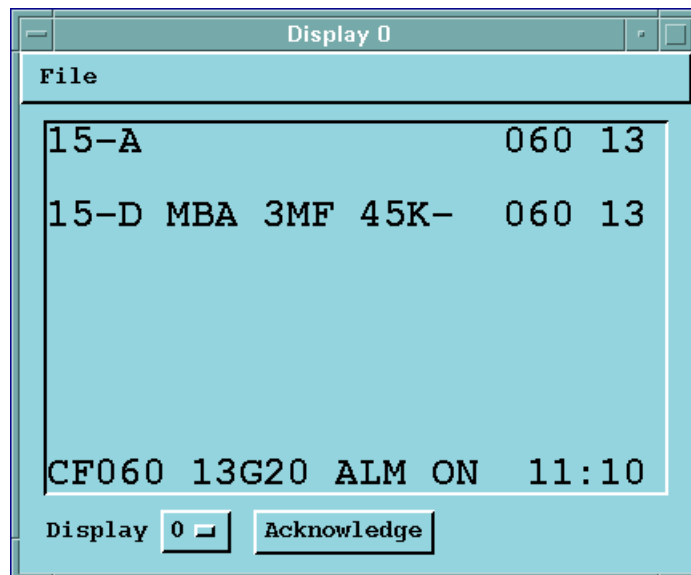
E.3.5 IRIS Virtual Ribbon Display

For systems that do not have the Dale model ribbon display, the IRIS Virtual Ribbon Display (vribbon) can be used. It is also convenient for “eaves dropping” on Dale displays to verify that they are properly configured, i.e., you can look at a virtual version of the Dale display.

Observers, Operators and Controllers can access the vribbon. The vribbon display is run locally on an SD by launching it from IRISnet or opening a terminal and typing:

```
$ vribbon
```

The display will appear as shown below.



The display has 10 lines. The top nine lines are used to display warnings for various approach and departure corridors. In the example, runway 15 departure has a microburst alert with a 45 knot loss. The threshold winds are reported as 060 degrees at 13 knots. The bottom line shows the center field wind data and the status of the alarm signal.

The vribbon can show any of the 8 physical ribbon displays. This is done by selecting the display number (0–7). The vribbon display also has a tone alarm which can be silenced (not disabled) using the Acknowledge button.

The next section describes how to configure the ribbon displays, i.e., what information appears on each line for each of up to 8 displays that may be attached to an IRIS workstation.

E.3.6 Ribbon Display Software Configuration



To run the IRIS software for ribbon display support, your system must be licensed for this feature and you must have operator privilege. Please check with your system manager.

Overview

The ribbon display setup utility provides the following functions:

- Runway approach and departure corridors are assigned to each line of the display.
- Up to eight displays can be configured for each IRIS workstation and the lines for each display can be set independently.
- Up to four different configurations can be saved. This is used for installations where different active runway assignments may require different display layouts.

This section covers the use of the ribbon display setup utility.

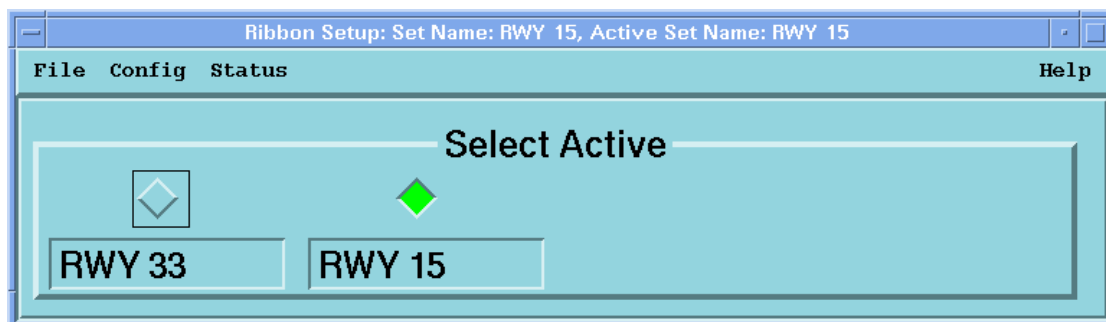
Configure Ribbon Displays Using the **ribsetup** Utility

After you have defined your protected areas, the **ribsetup** utility is used to define the appearance of the ribbon display, i.e., what runway information is displayed on each line of each ribbon display.

To start the **ribsetup** utility you must be an operator. Use a IRISnet or open a terminal window and type:

```
$ ribsetup &
```

The **ribsetup** utility will appear as shown below:



When the menu first comes up it is in “select” mode. The user can select among up to four different configurations that have been pre-defined. In the example above, two configurations are defined- one for runway 33 and the other for runway 15. The other two configurations are unused.

The configurations should be made to correspond to the actual runways that are typically used together in operation. When the terminal area is reconfigured in response to a new wind direction, this menu is used to select the appropriate ribbon display for the new configuration.

The features of the menu are described in detail below.

File

This provides the functions

- Load- used to restore the menu from the currently-saved file configuration if you want to “undo” changes.
- Save- saves your changes.
- Print- to print the menu for documentation purposes.
- Exit- to exit the menu. Note that ribbon displays will still be active when you exit.

Status

Select Status to see a submenu of the communication status of each of up to 8 ribbon displays that can be attached to your IRIS workstation.

Ribbon Setup Status								
	Disp 0	Disp 1	Disp 2	Disp 3	Disp 4	Disp 5	Disp 6	Disp 7
	Tower1	Tower2	ATC1	ATC2	none	none	none	none
Status	OK	Dead	Dead	Dead	Dead	Dead	Dead	Dead
Update Time	0.01	---.---	---.---	---.---	---.---	---.---	---.---	---.---
Input Count	24095	0	0	0	0	0	0	0
Output Count	222690	222754	222498	222461	21853	21853	21853	35077
<div>Cancel</div>								

The top row of the menu shows the ribbon display numbers for 8 displays that could be connected to your IRIS workstation. Note that your system may have fewer than 8 displays. The second row shows the names that have been configured for the displays. The last four names are set to “none” to indicate that these are unused.

The status of each ribbon display is indicated as either “OK” or “Dead”. A “Dead” display may have been turned-off or have a cabling problem. Also, the display number set on the display itself may be incorrect (see Section E.3.4 “Selector”).

The update time shows the time in seconds since the last communication between IRIS and the display. Input and output count are shown to indicate the number of bytes input from the display and output to the display. This is sometimes useful for debugging communications problems.

Config

The submenus under config provide the ability to customize the appearance of each ribbon display. These are discussed separately.

Config/Config ... (serial output port)

This selection determines which serial line output port is used for ribbon displays. Only a single port is needed since the displays are daisy-chained together. Type in the device name which will always have the form:

`/dev/ttyXXX`

The XXX depends on your system here are some examples:

- Linux ttyS0 or ttyS1
- HP tty0p0 or tty0p1

Check with your IRIS System Manager if you are unsure.

Number of Active Sets (1, 2, 3, 4)

This determines how many different active sets you want. In the example, there are two active sets. Active sets are named by simply typing in the name that you want and then doing a File→Save.

Display Setup Menu

This is to turn-on the setup menu which will appear as shown below. The setup menu is used to configure the ribbon display appearance for each active set.

The display configuration for an active set can be viewed by pushing the button under the active set name. Note that this will not change the active set on the ribbon displays, i.e., it only effects what is displayed and edited in the setup menu. The button turns yellow to indicate which set is being viewed/edited. In the example, the setup menu is set to view RWY 15 (yellow button).

The top of the setup menu shows the display number and is color coded red or green to indicate whether display status is “OK” or “Dead”. The display numbers correspond to the “Selector” position (0-7) that is configured on each of the ribbon displays. It is recommended that if, for example, you have four displays, that the selector switches on the displays be set to 0, 1, 2 and 3.

There is also a button next to the Display Number to select whether a display is enabled or not. If a display is installed, the button should be clicked-in. In the example, the first four displays (0-3) are enabled, but displays 1, 2 and 3 are dead (read color) indicating that they are either turned-off or there is a communication problem.

Beneath each display number is a display name (e.g., Tower1). These should be set to indicate the location or function of the particular ribbon display. It is recommended that you use the text “None” or “Unused” to indicate the case when a display is not installed. To change the name, simply type-in the text.

Ribbon Setup: Set Name: RWY 15, Active Set Name: RWY 15

File Config Status Help

Select Active

RWY 33 RWY 15

Clear Set

Configure: RWY 15

☐ Disp 0
 ☐ Disp 1
 ☐ Disp 2
 ☐ Disp 3
 ☐ Disp 4
 ☐ Disp 5
 ☐ Disp 6
 ☐ Disp 7

Tower1 Tower2 ATC1 ATC2 none none none none

15-A	15-A	15-A	15-A				
15-D	15-D	15-D	15-D				

The bottom part of the setup menu has nine entries for each display, corresponding to the nine lines that are available for warnings on a ribbon display. To configure what appears on each line, first highlight the line and then right-click the mouse to get a pop-up list of all possible corridors as shown below.

The corridor names are taken from the IRIS setup/product warning areas that were created (see the beginning of this section). In addition, there is a blank line (to configure blank lines on the display), and there are other arbitrary protected areas that may not be associated with a particular corridor. For example, a single large protected area could be configured to display alerts anywhere within 5 miles of the terminal.

The screenshot shows a configuration window for two displays, 'Disp 0' (green header) and 'Disp 1' (red header). Below each header is a button labeled 'Tower1' and 'Tower2' respectively. The main area contains a grid of buttons for selecting corridors. The first column has buttons for '15-A', an empty box, '15-D', an empty box, an empty box, an empty box, an empty box, and an empty box. The second column has buttons for '15-A', an empty box, '15-D', an empty box, an empty box, an empty box, an empty box, and an empty box. A submenu is open over the '15-D' button in the first column, showing a list of options: '15-A', '15-D', '33-A', '33-D', 'All', and 'East'.

Select the corridor from the submenu for each line of the display. Repeat the procedure for all of the displays.

In the example, each of the four displays that are enabled is configured identically. In general this is good practice since it makes the system easier to maintain. However, if your operation requires it, different displays can have different configurations.

To assist with major changes, use the “Clear All” button. If you make a mistake you can use File->Load to restore the saved values.

After you have configured a set, use File->Save to save your results. You may also want to do a File->Print to document your settings. Then you can click on a different set (yellow button under the set name) and configure the displays for this. Continue until you have configured all of the active sets.

E.3.7 Ribbon Display Testing with `tdwr_sim`



Do not run the `tdwr_sim` test utility during normal system operation since it may interfere with the signalling of actual warnings.

To test the ribbon display and for training purposes, SIGMET supplies a utility called **`tdwr_sim`**. The utility outputs a simulated TDWR product with alerts for selected corridors to verify that the ribbon displays are functioning. Note that this does not verify that warnings are properly generated by the IRIS system. To use the utility, start a terminal and type:

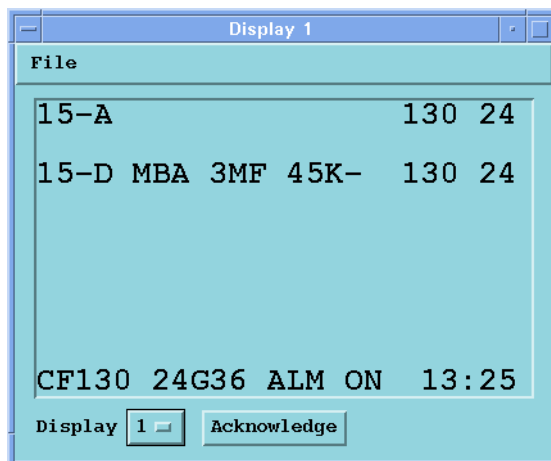
```
$ tdwr_sim
```

The utility will prompt you to “Enter Corridor Count”. Enter the number of corridors that you have on your system. In the example that has been used in this appendix there would be four (33A, 33D, 15A, 15D). The maximum count supported by the simulator is 16. Next hit <Enter> and the corridor names will be displayed line-by-line. You can type-in arbitrary text to generate a test message. A sample session is shown below:

```
Enter Corridor Count [4]: 4
Enter Alert type for Corridor 0 (15-A)[  ]:
Enter Alert type for Corridor 1 (15-D)[  ]: MBA
Enter Alert type for Corridor 2 (33-A)[  ]:
Enter Alert type for Corridor 3 (33-D)[  ]:
Sending product to IRIS.

Enter Corridor Count [4]:
```

At this point, `tdwr_sim` sends a simulated TDWR product to IRIS, which in turn transmitted to each ribbon display that is configured to show alerts for the selected corridor (in this case 15-D). This causes the ribbon display to have a warning message as shown below (illustrated with virtual ribbon display)



To clear an alert, simply hit <spacebar> to replace the warning with a blank line. If no new message is sent to the ribbon displays for 150 seconds, the text “NO DATA AVAILABLE” will be displayed on all ribbon displays. To stop `tdwr_sim`, type <Ctrl> c.

E.3.8 Summary of Ribbon Display Alert Messages

33-A MBA 3MF 40K- 180 14

Approach/Departure Corridor

Type of Alert (Microburst or Wind Shear)

Location (e.g, 3 miles final approach)

Expected airspeed gain/loss

Wind direction at threshold or other specified location

E.4 TDWR/LLWAS Integrator and Runways Utility

E.4.1 What is the “Integrator”

The TDWR/LLWAS Integrator is a separate software process (i.e., not part of the main IRIS software) which combines wind shear alerts from IRIS and an optional LLWAS system to generate TDWR products. The Integrator functions as a filter on the alerts, i.e., the integrator:

- Only passes alerts for runways that are active as specified by the runways utility.
- If an arena has two or more alerts, then the more important alert is passed, e.g., a microburst alert is more important than a wind shear alert.
- Only passes the alert for the arena of first encounter in a corridor. For example, if 33L_3MF and 33L_2MF both have microbursts alerts, then the 33L_3MF is alerted on the ribbon display since an aircraft would encounter this first.
- In the event of failure of a system, will use the alerts from the other system, e.g., if TDWR fails, then only LLWAS data will be used.
- For each arena, the alerts from TDWR and LLWAS are combined as follows: a strong alert (MBA) from either system is passed through, while a weak alert (WSA) requires confirmation from the other system. The thresholds for what is considered strong and weak are tuned for each site.

The TDWR products from the Integrator are sent back to IRIS for distribution to SD's to drive the ribbon displays. Please refer to the data flow diagram in Section E.1.4 and the more detailed figure on communication on the next page.

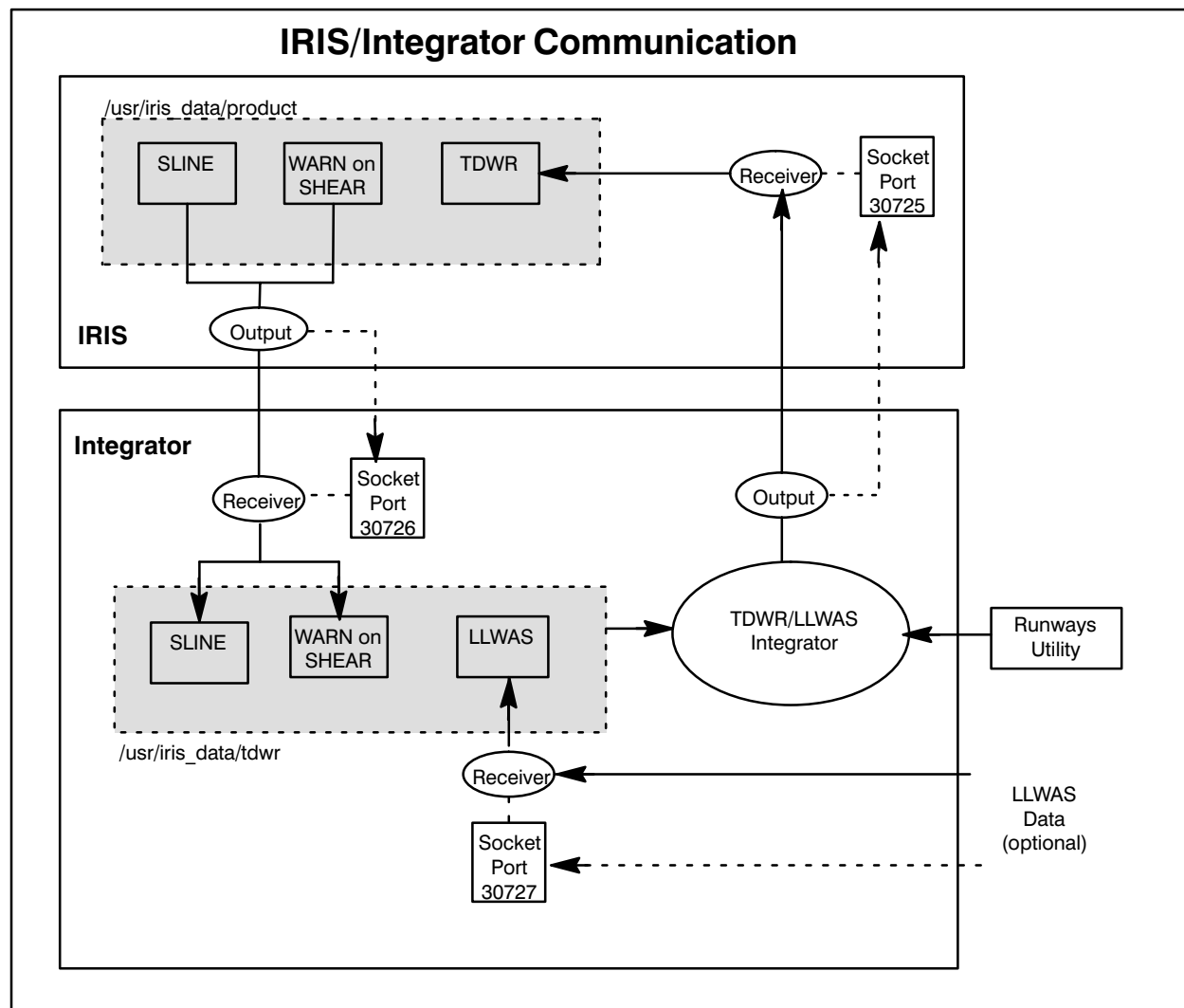
The Integrator takes as input the following data:

- SLINE products from IRIS (gust front warning)
- WARN (on radial shear) products from IRIS (microburst warning)
- LLWAS input data (if available, for LLWAS warnings).
- Active runway configuration from the runways utility.

A new TDWR product is made and output to IRIS whenever:

- New input data are received.
- The active runway configuration is changed.
- A maximum time-out has expired (specified time of order 60 seconds).
- The product sitename is the same as the radar sitename.

All of the inputs are used when a TDWR product is made, unless an input is “stale”, i.e., it is older than a specified time (of order 120 seconds). For example, if LLWAS fails, the Integrator will continue to use the old LLWAS data until the time limit for “stale” data is reached. If all of the data are “stale”, no TDWR product is made at all. In this case, there will be no output to IRIS and the ribbon displays will eventually show “NO DATA AVAILABLE”.



E.4.2 Configuring the Integrator and Runways Utility- **runways.conf**

The configuration of the Integrator and the runways utility is stored in the **runways.conf** file. This is kept in the IRIS_CONFIG directory which is assumed here to be the standard **/usr/sigmat/config** directory. Refer to the preceding figure for a conceptual picture of the configuration. This section describes the file and how to configure it. The configuration steps are:

- Create the **tdwr** data directory (default location **/usr/iris_data/tdwr**)
- Install the **runways.conf** file (default location **/usr/sigmat/config/runways.conf**)
- Edit the **runways.conf** file.

Create the directory **/usr/iris_data/tdwr**

You must have root privilege for this step. The **tdwr** directory can exist anywhere on the workstation that runs the Integrator. However, we recommend that you put it in the same place that you put the IRIS_PRODUCT product directory. For a standard installation this will be in a directory called **/usr/iris_data**. This may be different on your system. If so, simply substitute the appropriate directory. To see the location of the product directory check **/usr/sigmat/config/profile**.

To make the **tdwr** directory, login as root or become the super user and then:

```
# cd /usr/iris_data
# mkdir tdwr
```

To complete this step, set the privileges for the directory to match the other directories (do an **ls -ll** to see how the other directories are set). For a standard installation you will need to type:

```
# chown operator tdwr
# chgrp users tdwr
# chmod 777
```

Install the **runways.conf** file

The **runways.conf** file is kept in the **/\$IRIS_ROOT/config** directory (usually **/usr/sigmat/config**).

First check to see if the file exists in this directory. Login as operator and type:

```
$ cd /usr/sigmat/config
$ ls
```

The **runways.conf** file should be in the list. If it is not, then copy the template as follows:

```
$ cp /usr/sigmat/config_template/init/runways.conf /usr/sigmat/config
```

Edit the **runways.conf** file

Now edit the **runways.conf** file (use **vi**, **emacs** or your ASCII text editor). The file is shown below:

```
# File: ${IRIS_CONFIG}runways.conf
# Contains configuration information for the TDWR/LLWAS integration
# algorithm and the runways utility.

# Number of runways to define:
COUNT 3

# For each runways: Primary direction, Secondary direction, default direction.
# The default direction is the direction to use at powerup until changed
# manually by runways.
RUNWAY 1 33- 15- LLWAS
RUNWAY 2 36R 18L LLWAS
RUNWAY 3 36L 18R LLWAS
# Uncomment this if you want all corridors reported out of integration.
#DONT_FILTER_RUNWAYS

# Turn logging on, choices are FILE or TERM or BOTH or NONE
LOG BOTH

# Define input related info:
# Socket port; Directory; Timeout to consider input data stale
IRIS_IN      30726
IRIS_IN_DIR  /usr/iris_data/tdwr/
IRIS_IN_TIME 120

# Define output related info:
# Socket host and port; Directory;
# Timeout to retransmit output even with no changes
IRIS_OUT      cyclone 30725
IRIS_OUT_DIR  /usr/iris_data/product/
IRIS_OUT_TIME 60

# Define LLWAS input related info:
#LLWAS_IN      30727

# Since the LLWAS input does not contain sitename or lat/lon. These
# need to be specified to handle the case where IRIS input is lost.
# For systems with no LLWAS input, it is recommended that you comment
# this whole section off.
# Specify radar lat and lon in signed degrees. Negative is south latitude, or
# West longitude.
RADAR_LATLON 43.00 -71.00
# If you want to take the latlon from the IRIS input, if available, then
# comment out this line.
ALWAYS_SET_LATLON

# Specify desired radar sitename. Max 16 chars, requires quotes if you
# have imbedded whitespace.
RADAR_SITENAME "THIS IS A TEST"
# If you want to take the sitename from the IRIS input, if available, then
# comment out this line.
ALWAYS_SET_SITENAME

# List of users who are allowed to operate the runways utility.
OPERATORS operator

# End of file
```

The various lines in the file are described in detail below:

- **COUNT 3**
This is the number of physical runways, i.e., strips of concrete.
- **RUNWAY 2 36R 18L LLWAS**
For each runway, an arbitrary number is assigned (e.g., 1, 2 and 3). These numbers should be sequential starting from 1. The names for each runway are then specified in the next two fields (e.g., 36L and 18R). The last field is the default active runway when the software is first started. This can be either of the runway names or, if available, LLWAS. In the LLWAS case the runway direction specified in the LLWAS data is used when the Integrator is first started. If there are no LLWAS data, then the runway direction in the first field is used on start-up.
- **# DONT_FILTER_RUNWAYS**
This line should generally be left commented (the # sign). If it is un-commented (# sign removed), then the integrator will pass-on alerts for all arenas, even if they are not associated with active runways. Filtering can still be performed by the ribbon displays, i.e., ribsetup can be configured to exclude inactive runways (see Section E.3.6).
- **# Turn logging on, choices are FILE or TERM or BOTH or NONE**
LOG BOTH
If you are starting the integrator from a terminal, then set this to “BOTH”. If you are starting the integrator automatically, then set this to “FILE”. The log file will be stored in **/usr/iris_data/log**.
- **IRIS_IN 30726**
IRIS_IN_DIR /usr/iris_data/tdwr/
These entries configure the characteristics of the input from IRIS to the Integrator. IRIS_IN is the socket port that is used by IRIS to notify the Integrator when a new product is sent. This must match the IRIS setup/output network device that has been configured to send products from IRIS to the Integrator. The default port is 30726.

The IRIS_IN_DIR is the directory where IRIS sends products to the Integrator. This must match the directory configured at the beginning of this section and the directory configured in IRIS setup/output for the TDWR integrator (Section E.2.3)

- **IRIS_OUT cyclone 30725**
IRIS_OUT_DIR /usr/iris_data/product/
These entries configure the characteristics of the output from the Integrator to IRIS. IRIS_OUT is the nodename (cyclone) and socket port (30725) where IRIS will receive the data. Usually this is the local workstation where the Integrator is running. The socket port should match the IRIS_NETRCV environment variable

for the network receiver. This is set in the **/usr/sigmet/config/profile**.

The IRIS_OUT_DIR is the directory where TDWR products will be sent. This must match the directory configured for IRIS_PRODUCTS- typically **/usr/iris_data/product**. This is set in the **/usr/sigmet/config/profile**.

- **IRIS_IN_TIME 120**

This is the time in seconds, after which, an input is considered to be “stale”. For example, if the LLWAS stops sending data, the Integrator will continue to use the old LLWAS data for a period of 120 seconds (in the example). After 120 seconds, the old LLWAS data will not be used to make new TDWR products.

- **IRIS_OUT_TIME 60**

This is the maximum time between generation of TDWR products. A new TDWR product is made whenever one of the following happens:

A new input arrives.

The active runways configuration changes

One of the inputs becomes stale (IRIS_IN_TIME times-out)

IRIS_OUT_TIME from the last TDWR product generation is exceeded.

Thus the IRIS_OUT_TIME assures (in this example) that a TDWR product will be created at least every 60 seconds provided there are valid inputs (data are not stale).

- **LLWAS_IN 30727**

This is the socket port that is used by LLWAS to notify the Integrator when a new LLWAS data are available. If you do not have an LLWAS, comment this line by adding # to the beginning.

- **<LLWAS Site Information>**

If you have an LLWAS system, you will need to specify the LAT/LON of the radar and the sitename since these are not in the LLWAS header. This information is needed if the radar fails and the alerts are based on LLWAS alone. If you do not have an LLWAS, then comment all lines of this section.

- **OPERATORS operator controller>**

This is used to control access to the runways menu to the user ID's in the list. Note that anyone can view the runways menu, but only users in the list can change it.

E.4.3 Starting the Integrator

Manual Integrator Start-up

To start the TDWR/LLWAS Integrator you must be an IRIS Operator. In a terminal window on the workstation where the Integrator is run (typically an RPG IRIS/Analysis system) type:

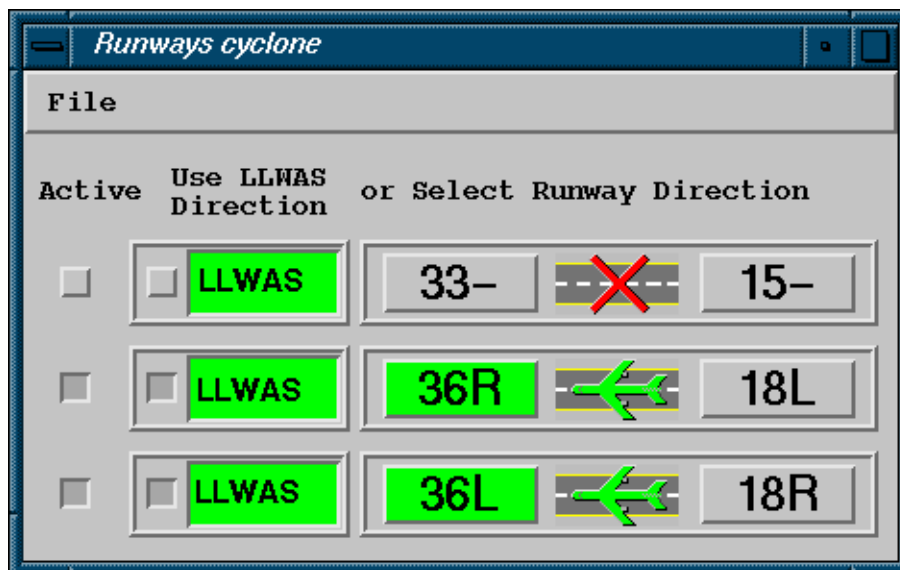
```
$ tdwr_llwas_int
```

This will start the software and log events in the terminal window. Iconify the terminal so that you can read any messages in the log.

Automatic Integrator Startup

The recommended approach is to start the integrator automatically when the workstation boots-up. This is done by creating a startup file in a manner identical to the automatic “siris” startup. Refer to the *IRIS Installation Manual Chapter 1* for creating automatic startup procedures for your specific platform and operating system.

E.4.4 Runways Utility



Overview

The **runways** utility is used by controllers to specify which runways are active. This information is used by the TDWR/LLWAS Integrator algorithm to filter alerts from inactive arenas. For example, each runway arena has two names, e.g., 33L_3MD is the same physical arena as 15R_3MF. The runway direction specified in the **runways** utility determines which of these names is used to identify the arena. Also, if a runway is not used, the entire runway and all of its associated arenas may be set to inactive.

The **runways** utility must be run on the same IRIS node where the Integrator is run (typically this is the IRIS workstation assigned to generate products), however you can export the **runways** display to another workstation on the network. Thus the **runways** utility can be run from any networked workstation.

Whether you are on a local or remote workstation, you must have privilege to logon to the system. Note that most installations allow Observers to view the runways utility, but only Controllers (and perhaps Operators) can change the runway direction. The "OPERATORS" line in the runways.conf file is used to specify which users can control the **runways** utility (see Section E.4.2).

Starting the Runways Utility

- The **runways** utility may be configured to start automatically on your system, This is configured by the system manager. Refer to the *IRIS Installation Manual Chapter 1* for creating automatic startup procedures for your specific platform and operating system.
- The easiest way for manual start is to use IRISnet. Click on the node where the Integrator is run. This will pop-up a tools menu. Click the runways icon in the tools menu. If the runways icon is not in IRISnet tools menu, contact your system administrator.
- The other (less easy) way is to use a terminal and type:

```
$ runways &
```

If you are on a different workstation you can use `rlogin <nodename>` or `sigterm <nodename>` to open a terminal on the node where the integrator is run. Note that if you use the `rlogin` approach, then prior to running runways you will also have to type the following:

```
$ export DISPLAY=<yournodename>:0.0
```

This exports the runways display to your workstation. If the runways display does not appear on your workstation, then you may need to type the following on a terminal on your workstation (not the remote system):

```
$ xhost +
```

This authorizes windows from other workstations to appear on your display. Check with your system manager if you want this automatically enabled.

Stopping the Runways Utility

To exit the runways utility select File→Exit in the upper left. Note that the settings specified in the runways utility will still be used by the Integrator after you exit.

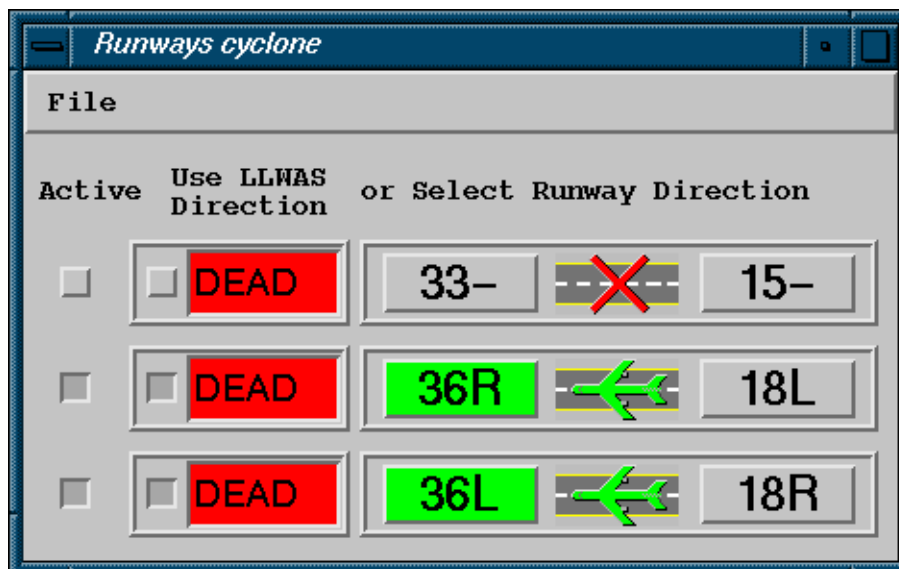
Setting Active/Inactive Runways

Each runway that is configured in `runways.conf` will have a line in the menu as shown at the beginning of this section. The button in the far left column activates/deactivates the runway. Inactive runways are indicated by the “X” symbol over the runway, as shown in the example for 33/15.

Selecting the Runway Direction

The runway direction is indicated by the green color of the runway name and the direction of the aircraft icon. The runway direction can be selected either manually by clicking the runway name, or automatically by LLWAS (if available). To enable the LLWAS automatic selection, click the button on the LLWAS column for each runway.

LLWAS Status



If LLWAS is available on your system, its communication status with the integrator is displayed in the LLWAS column. The image above shows the display "DEAD" in red background to indicate the LLWAS is not communicating to the Integrator.