

# LRIT DOMAIN 6

## **User's Guide** Avtec Systems, Inc.

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# **LRIT Domain 6**

## **User's Guide**

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## Support

### Technical Support

This manual provides engineers with integration and programming information necessary to develop an LRIT Domain 6 system. LRIT Domain 6 Technical Support is available from AVTEC Systems, Inc.

Avtec Systems, Inc.  
Attn: LRIT Domain 6 Technical Support  
14432 Albemarle Point Place  
Chantilly, VA 20151-1678  
(703) 488-2500  
[support@avtec.com](mailto:support@avtec.com)

### Customer Service

Direct non-technical questions and business related matters to Customer Support.

## REVISION HISTORY

REV.	DESCRIPTION	DATE	APPD.
-00	Baseline release.	09-17-2002	D. Irvin
-01	Incorporated in accordance with ECN A0096. Added support for Comtech CDM-550.	12-10-2002	D. Irvin
-02	Incorporated in accordance with ECN A0137. Added field and comments to LritReceiver's Options Dialog.	03-03-2003	D. Irvin
-03	Incorporated in accordance with ECN A0358. Added comments for Session Layer Post-Processing	01-20-2005	D. Irvin

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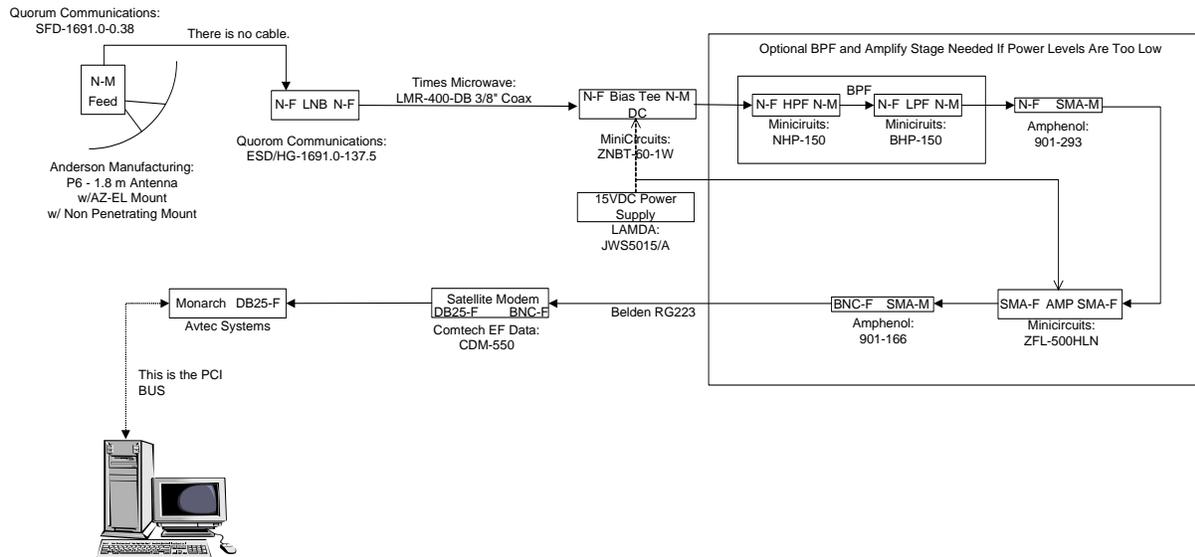
# 1. INTRODUCTION

The Domain 6 software for LRIT is designed to be an easy-to-use suite of programs, with an intuitive interface. This manual assumes the reader of this manual and hence operator of the software need have a general knowledge of computing. It also assumes the reader knows a moderate amount about the transmission of the data into Domain 6, CCSDS, and the LRIT system in general.

There are three main programs in the Domain 6 suite:

- 1) LritReceiver
- 2) LritFileProcessor
- 3) LritViewer

Each program performs a certain subset of functionality in Domain 6. LritReceiver is designed to read the data coming in from the satellite modem and recreate the LRIT files. LritFileProcessor is designed to provide automatic processing of those files, such as printing and archiving them, among other functions. LritViewer is pretty part of the suite, it lets you view the contents of the LRIT files, be it text or images. Each program is discussed in more detail later in this document.



The above figure shows the basic connections for the LRIT User Terminal. The Domain 6 suite resides on the host computer and the LritReceiver uses the Monarch card to read the data from the satellite modem.

## 2. INSTALLATION AND CONFIGURATION

The installation process for Domain 6 Version 1.0 is designed to be quite easy. An installer will be provided to guide you through the process. This section is only for the software installation; it does not include any details on hardware installation.

### System Requirements:

Operating System:	Microsoft Windows NT/2000
Processor:	600 MHz or higher
Memory:	256 MB or higher
Disk Space:	10 MB for Domain 6 software 500 MB or more for LRIT files
Other Hardware:	Avtec Monarch-E Serial I/O PCI Board

### Step 1- Installation of Software

It is recommended that you install the Domain 6 software before you physically install the Monarch-E card into your system. This is because certain driver files will be copied to your hard drive, which will facilitate installation and configuration of the Monarch-E.

Start the installation program by running the Setup.exe program on the LRIT Domain 6 Installation CD.

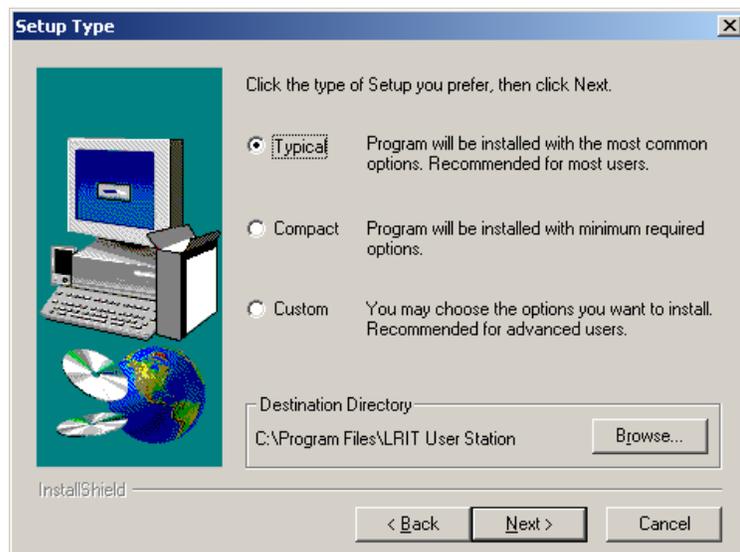
You will first be prompted for the installation directory. By default this is C:\Program Files\LRIT User Station.

The next step is to choose the type of installation to perform. Most users will use the "Typical" installation. This will install the application files, the Monarch-E driver and associated hardware files, and some documentation on how to use the Domain 6 software.

The Compact installation only installs the application files and the hardware support. It does not install the documentation.

The Custom installation allows you to pick and choose which components you want to install. If you are using the Comtech EF Data CDM-550 satellite modem, you must use the Custom installation to install the support for the CDM-550.

After copying the software to your hard drive, the installer will prompt you to restart your computer. If you are going to install the Monarch-E card immediately after this installation, it is



recommended to choose the "Restart Later" option, but then shut your computer down to install the card. If you installed support for the Comtech CDM-550, you must restart your computer before it will recognize the support.

## **Step 2 - Installation of the Hardware (Avtec Monarch-E)**

If you are not installing the Avtec Monarch-E card, you can ignore this section.

It is assumed you know how to install PCI cards in this section. If you do not, it is recommended you have someone who does perform this section on your behalf.

Power down and put the card into the system. Reboot.

If you are using Windows 2000, it should recognize that new hardware has been found, and will prompt you for a driver file. The Domain 6 software installation installed the Monarch.inf file in the WinNT\system32 directory, which contains all settings you will need you use the board. You should have the Hardware installer browse to the WinNT\system32 directory, and it should automatically come up with the options for the Avtec Monarch-E PCI card.

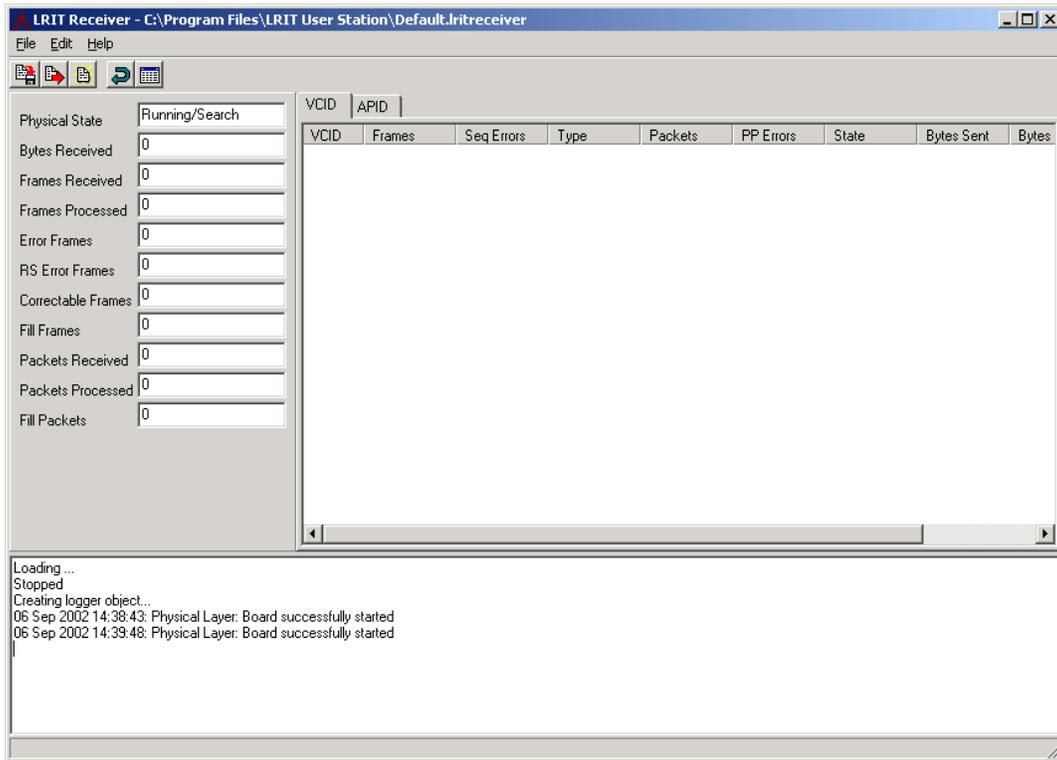
If you are using Windows NT, all registry settings needed were set with the Domain 6 software installation. Upon reboot it will be able to use the Monarch-E card.

## **Step 3 - Configuration of the Software**

All Domain 6 applications each have a default configuration, and should operate quite well with most installations. Review the application sections of this document for details on how to change different configuration items.

### 3. LRITRECEIVER

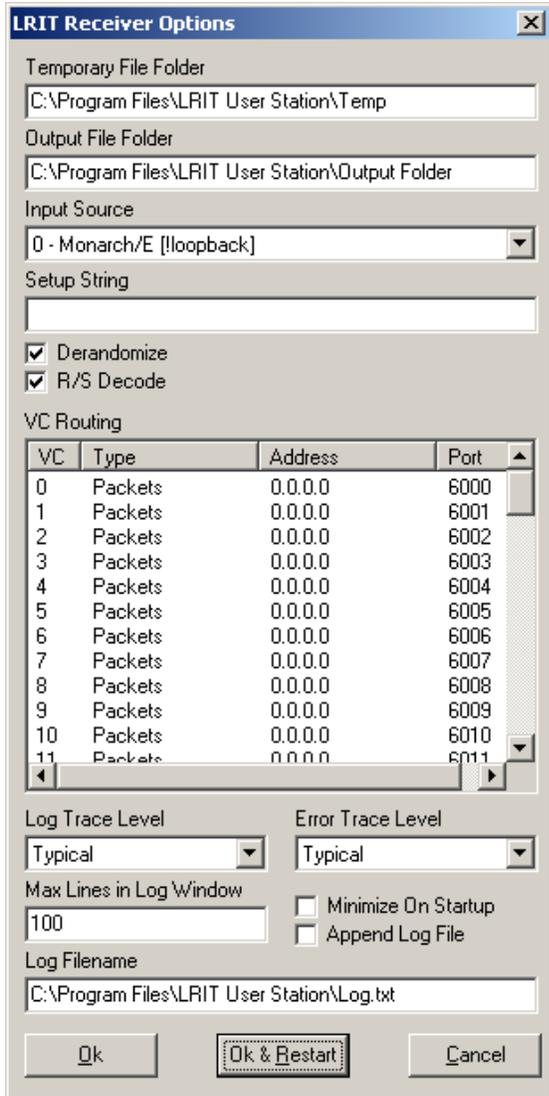
LritReceiver, as was mentioned previously, is the application that reads data in from the satellite modem, and decodes the data into LRIT files. As it does this it will display certain statistics about the data processed, such as how many frames and packets were received. Here is a screen shot of the main window of LritReceiver:



The LritReceiver window consists of five main areas: Menu/Toolbar area, the Statistics (left) area, the Logging and Messages (bottom) area, and the two tabbed windows on the right: the VCID window and the APID window.

#### 3.1 Menus and Toolbars

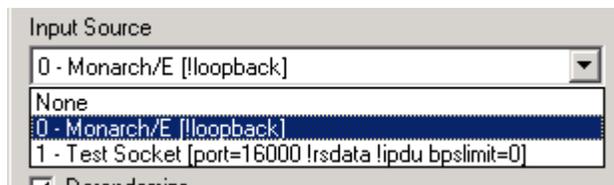
The File menu gives the standard options of Save, Save As, Open, and Exit. When saving and opening files, remember that these operations are on the configuration files, not on LRIT files.



The Edit menu gives the option to open the Options dialog and to Restart the physical layer. The Options dialog allows you to change the different configuration items. To the left is a screenshot of the options dialog.

The Temporary File Folder is the folder that the receiver will use to temporarily store the LRIT files as it is receiving them. After the transfer is complete, it will then save the files in the Output Folder.

The Input Source pull-down list is a list of different Physical input devices. LritReceiver is designed to allow for different physical device interfaces to be used as the data input source. Below is a screenshot of the list of different devices available at the time of writing.



This list shows three different options: None, a Monarch-E board, and a Test Socket. As you can see, the Monarch-E is selected as the Input Source. The Test Socket option uses a TCP/IP socket as the

input source. The Test Socket option displays the setup string it uses. Basically it will listen on port 16000 with no limit on the read rate. It also doesn't expect Reed-Solomon encoded data or IPDU-encapsulated frames. It is recommended to use an Avtec Systems, Inc. Monarch-E serial board as the input device.

The setup string, as seen in the both the Monarch/E and Test Socket descriptions, is basically a user-configurable setup for the physical layer.

Setup options for Monarch/E:

loopback      If this string is present, the board will operate in loopback mode. This mode is used for test purposes only.

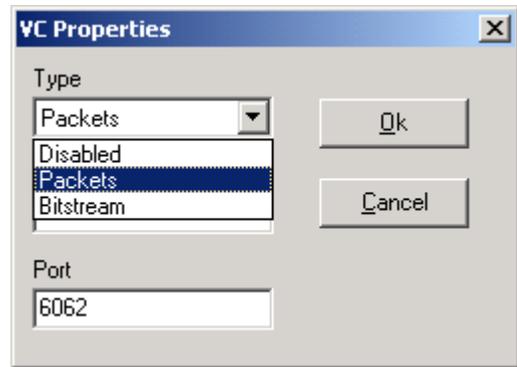
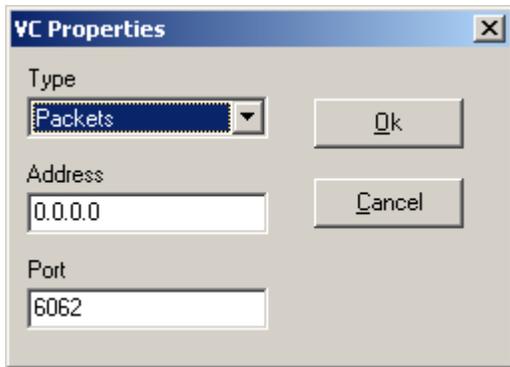
Setup options for the Test Socket:

port=X          Listens for data on TCP/IP port X. Default is 16000

- ipdu                 Determines whether or not each frame is an IPDU-encapsulated frame. The keyword "ipdu" tells the test socket to accept the ipdu header. Default is !ipdu, or to not use IPDUs.
- rsdata             Determine whether each frame includes the Reed-Solomon check symbols. Default is !rsdata, or no Reed-Solomon symbols in the frame.
- bpslimit=x         Limits the rate at which it will read data from the input source. Default is 0, which will not limit the rate.

The check boxes Derandomize and R/S Decode determine if the receiver will perform derandomization and Reed-Solomon decoding on each input frame. The default transmission of LRIT data is Reed-Solomon encoded and randomized frames, so these should be checked.

The VC Routing table allows the user to route different virtual channels. In the normal use LRIT files, in the form of packets, will be transferred on all virtual channels. In that case, the Packets case, the routing information is not used. However, Domain 6 was designed with the capability of extracting a bit stream inserted into LRIT using the CCSDS Bitstream service, and output that data to a TCP/IP port. By right clicking on a VC, you can change type and address/port on which to output the bitstream data. Here are two screen shots showing this dialog.



The type is what type of data will be transferred on this virtual channel. The default is Packets, which disables the Address and Port. When Bitstream is selected the Address/Port is the address and port on which to listen for a connection for a transfer of the bitstream data. The default address is 0.0.0.0, which is the default IP for the host. This allows for multi-homed machines.

The Minimize on Startup checkbox determines if LritReceiver will start up only in the system tray. The default is off.

The Log Trace Level and Error Trace Level choice boxes let you determine the amount of messages and errors that will be displayed in the logging area. The Log Filename is the file it will log messages to.

The Max Lines in Log Window field allows you to limit the number of lines that appear in the logging area. This helps with memory performance. The higher the number in this field, the more memory the application make take up. The default is 100, which is adequate for most purposes.

The OK button will accept the new configuration and close the dialog. The OK & Restart button will do the same as the OK button, but also restart the physical layer using the new options. Cancel closes the dialog not changing the options.

The Help Menu only has one option, About. This just displays the about dialog with some basic information about LritReceiver.

The Toolbar lets you do certain menu functions with a single mouse click. The functions on the toolbar, from left to right, are Save, Save As, Open, Restart, and Options.



### 3.2 Statistics Area

Physical State	Running/Search
Bytes Received	0
Frames Received	0
Frames Processed	0
Error Frames	0
RS Error Frames	0
Correctable Frames	0
Fill Frames	0
Packets Received	0
Packets Processed	0
Fill Packets	0

The statistics area of the main window shows details about the data coming into the receiver. Most values are fairly self-explanatory.

Physical State displays what the state of the physical layer is. If the input source is the Monarch-E, or a similar serial/frame synchronizer board, this should display “Running/Search” or “Running/Lock”, depending on if it is synched onto the frame input source.

Error Frames is the number of frames processed in which something was wrong. This however does not include RS Error Frames or Correctable Frames.

RS Error Frames is the total number of frames with some sort of Reed-Solomon error, either correctable or uncorrectable. Correctable Frames is the count of frames with correctable Reed-Solomon errors. Hence, the number of uncorrectable frames is RS Error Frames – Correctable Frames.

### 3.3 Logging Area



The logging area is just an area where different messages are displayed. Errors will be displayed in red, with all other messages in black.

### 3.4 VCID Tab

The VCID tab shows the details for the each of the different virtual channels. Each entry displays the number of frames, sequence errors, and the type of data on that virtual channel. It also displays the number of packets and number of packet processing errors.

VCID	Frames	Seq Errors	Type	Packets	PP Errors	State	Bytes Sent	Bytes
0	1793	0	Packets	195	0	--	--	--

When the bitstream service is assigned to a certain virtual channel, it displays different data. The state will display whether it is listening for a connection, or connected if a client is connection and awaiting data. It will also show the number of bytes sent, bytes buffered for sending, or bytes dropped if there is no client connected.

### 3.5 APID Tab

The APID tab shows the details for each of the different APIDs. It shows the number of packets received, the temporary filename it is using, the status of the file, and number of bytes received thus far. It also displays the number of packet sequence errors and CRC errors.

APID	Packets	Temporary Filename	Status	Bytes	Seq Errors	Cf
0	53	C:\Program Files\LRIT User Station\Te...	Accumulating...27%	433636	0	0

### 3.6 Session Layer Post-Processing of LRIT Files

The LritReceiver also has the capabilities to perform extended processing on the LRIT files after they have been fully received, when using a Session Layer of version 1.0.3 and above. The Session Layer, which is one of several layers that perform different portions of the receive processing, has the job of processing the received files for file-level compression and other types file level processing, such as renaming the assembled file to that provided in the file headers. With Session Layer versions 1.0.3 and above, this processing is extended to incorporate TCP socket and/or RS-232 serial port output. This functionality is provided to facilitate distribution of stream data encapsulated in LRIT files, otherwise known as “Bitstream in files” data. This is primarily use with the EMWIN file type, but may be used with future file types.

The configuration of this functionality is located in an XML file in the base LRIT program directory, e.g. “C:\Program Files\LRIT User Station”, and is named “FileProcessMap.xml”. An example file is detailed below.

```
<?xml version="1.0" ?>
<LritProcessMap>
<ProcessEntry fileType="214">
    <ProcessSpec consumeFiles="yes" useSerial="yes" serialSettings="1"
        useTCPSocket="yes" IP="0.0.0.0" port="21200" />
</ProcessEntry>
</LritProcessMap>
```

The base document element is tagged with the name “LritProcessMap”. The LritProcessMap has a set of elements tagged “ProcessEntry”, or can contain no ProcessEntries if the user does not want to post-process the “Bitstream in files” data. Each ProcessEntry consists of an attribute “fileType” and specifies with type of file you want to perform processing on. This value is specified in the LRIT files primary header, and is set by the producer of the data, e.g. NOAA. The ProcessEntry also has a child element tagged “ProcessSpec”, and is where the nuts and bolts of the processing is specified. Below is a table describing the attributes of the ProcessSpec.

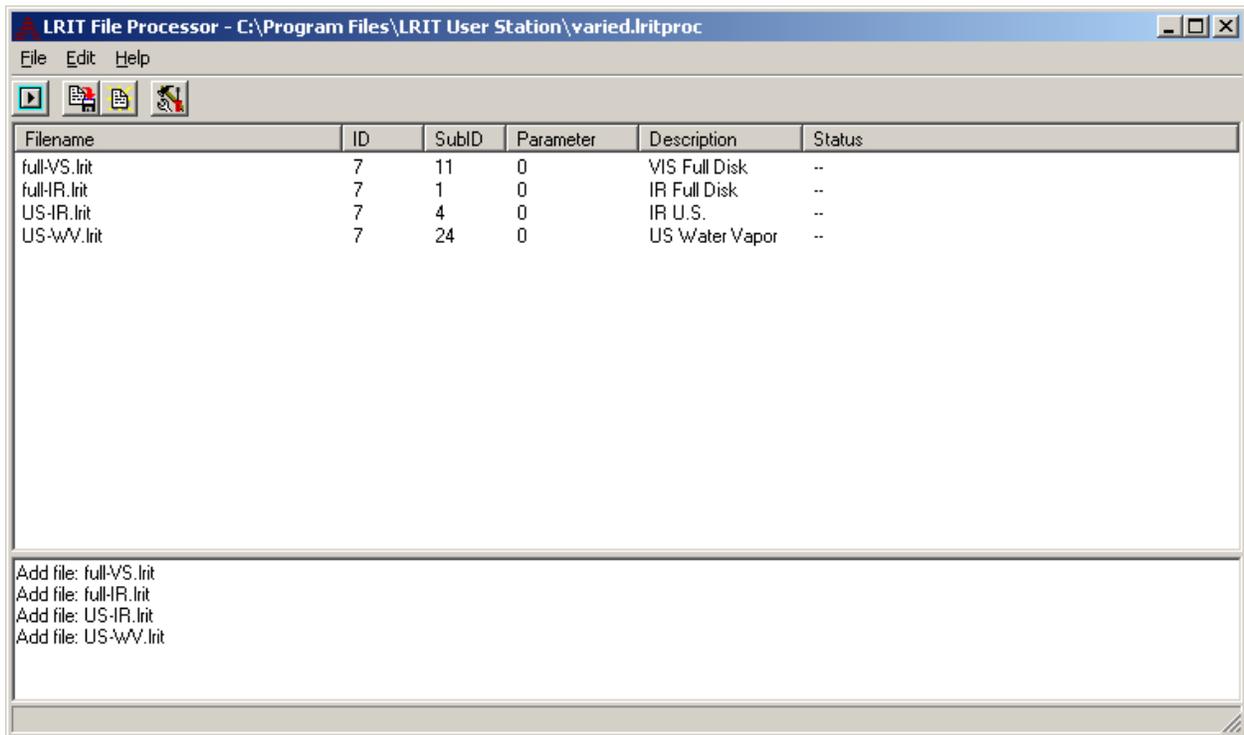
Attribute Name	Valid Values	Description
consumeFiles	“yes” or “no”	If “yes” the temporary file is consumed by the data output processing, meaning the temporary file is deleted and not archived.
useSerial	“yes” or “no”	If “yes”, serial port output is enabled.
serialSettings	COM port number e.g. “1” for COM1.	If “useSerial” is enabled, gives the numbers of the COM ports on which to output the data. Multiple COM ports may be specifies by delimiting the number with a “;”(semicolon), e.g. “1;2” for outputting on both COM1 and COM2. Each COM port speed is always 19200, and uses 8 data bits, No parity, and 1 stop bit.
useTCPSocket	“yes” or “no”	If “yes”, TCP socket output is enabled.
IP	IP address	If “useTCPSocket” is enabled, specifies the IP address on which to bind the TCP server.

port	0-65536	If "useTCPSocket" is enabled, specifies the TCP port number on which the server is to accept connections.
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## 4. LRITFILEPROCESSOR

The LritFileProcessor is the automation machine for Domain 6. Its basic function is to watch a directory for LRIT files, and according to different rules, do different things for each rule.

There are three basic areas to the main LritFileProcessor window, the Menu and Toolbar area, the File List area (top), and the Logging area (bottom). Here is a screen shot of the main window.

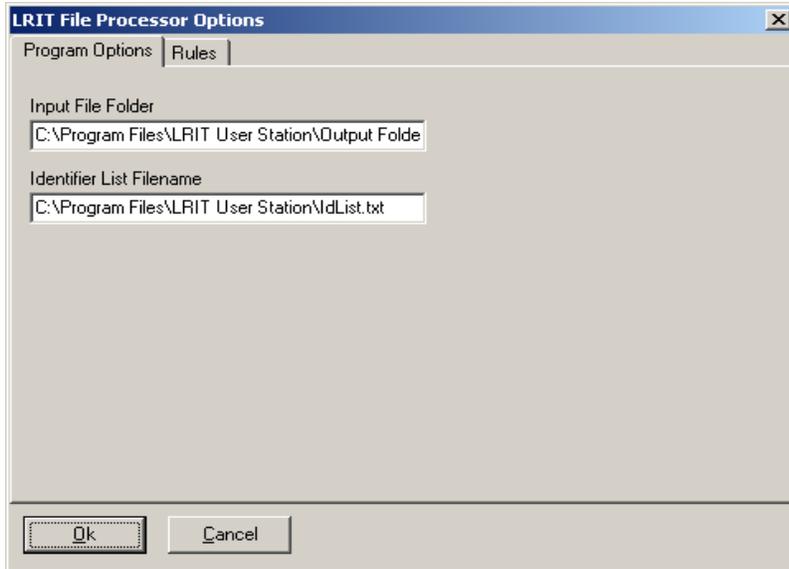


### 4.1 Menu and Toolbar Area

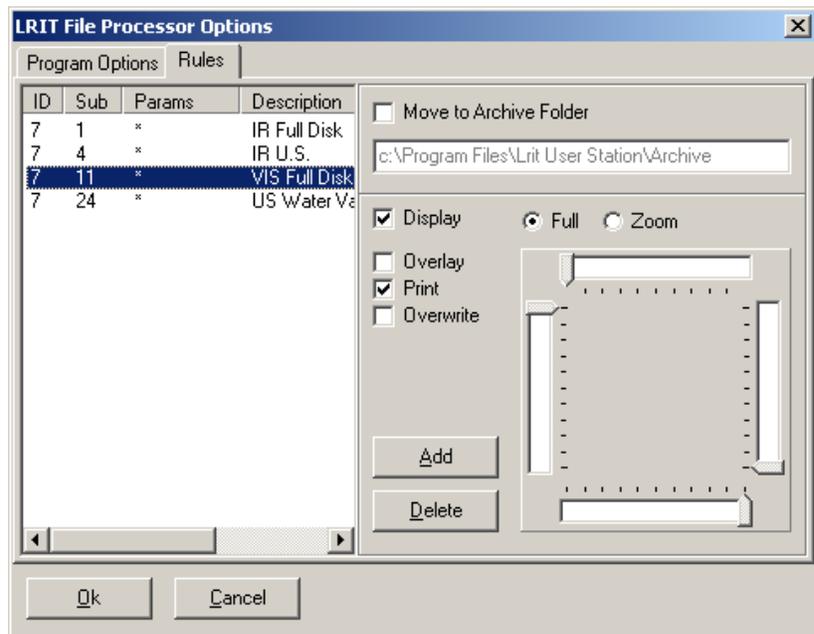
The LritFileProcessor application has three menus. The File menu has the standard Save, Save As, Open, and Exit functions. The Edit menu allows you to open the Program Options dialog. The Help menu allows you to open the About dialog, displaying general information about LritFileProcessor.

The Program Options dialog is where you determine the real behavior of the processor. It has two tabs: the Program Options tab and the Rules tab.

The Program Options tab basically sets up to two things. The Input File Folder is the directory that the processor is to watch for new files. The Identifier List Filename is the text file that gives a list of products (ID, SubID, Param) and a description for each.



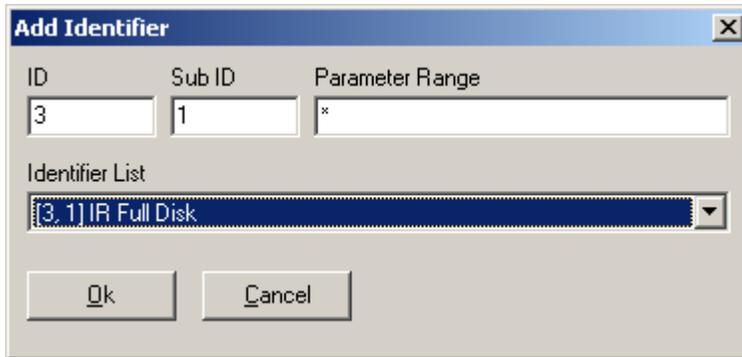
The Rules tab contains the rules that the processor uses to process files. Each entry in the Rules List (left) defines a single rule. A rule can contain many steps. A rule can move a file to an Archive Folder, or it can provide automatic display in LritViewer. If display is enabled, you can do even more. The Overlay option allows you to automatically overlay latitude and longitude lines over the image. Print will automatically print the image using the default printer. Overwrite is an interesting feature. If another file is open that has the same product tri (ID, SubID, Param) as the new file, it will close the old file and open the new file in its place. This is useful to monitor the most recent version of a product.



Using the Full/Zoom radio buttons adds some interesting behavior. If Full is selected it will open the file displaying the full image. If Zoom is selected, you can use the four slide bars to set a zooming region, relative to the entire image. The top slide will set the position of the leftmost

column, while the left slide will set the topmost row. These two together therefore set the upper-left corner of the region. The bottom slide and right slide can be used similarly to set the lower-right corner of the region. These two points determine the bounds of the zooming region. Using this capability, you can monitor a specific region quite easily.

The Add and Delete buttons will add a new rule or delete a selected rule. When you add a new rule a dialog requesting the product information on which you wish to add a rule. Here is a screen shot of that dialog.



You can use the Identifier List to set the ID,SubID pair. The \* character is the wildcard. You can use this to apply a rule to all possible values. You can see its use here in the Parameter Range. In the parameter area you can also specify a range, or list of ranges. You can use a value such as "1-155, 800-812,816,10002,15000-". This will apply a rule where the parameter is

in the ranges 1 to 155 and 800 to 812. The value can also be 816 or 10002. The range "15000-" will list all parameters 15000 and higher, up until the maximum value of the parameter.

The Toolbar area allows you to access certain menu operations with a button-push, with one exception. The first button, which looks like the play button on a CD-player, tells the processor to begin its processing of the directory. When this is depressed, a viewer will usually be launched. The button will stay depressed until clicked again. The other buttons perform the menu operations Save, Open, and Program Options, from left to right.



### 4.2 File Area

The File area shows the processing details for each file in the input directory. It will display the filename, the product details, and processing status. The product details include the product ID, SubID, and Parameter assigned to each file by NOAA. These values are referenced to a description file, as to provide a textual description for each (ID, SubID, Param) value. The status field shows at what stage in the processing it is currently in. Below is a screen shot showing the file area in during processing.

Filename	ID	SubID	Para...	Description	Status
full-VS.lrit	7	11	0	VIS Full Disk	Displaying... 14%
US-IR.lrit	7	4	0	IR U.S.	
US-WV.lrit	7	24	0	US Water Vapor	

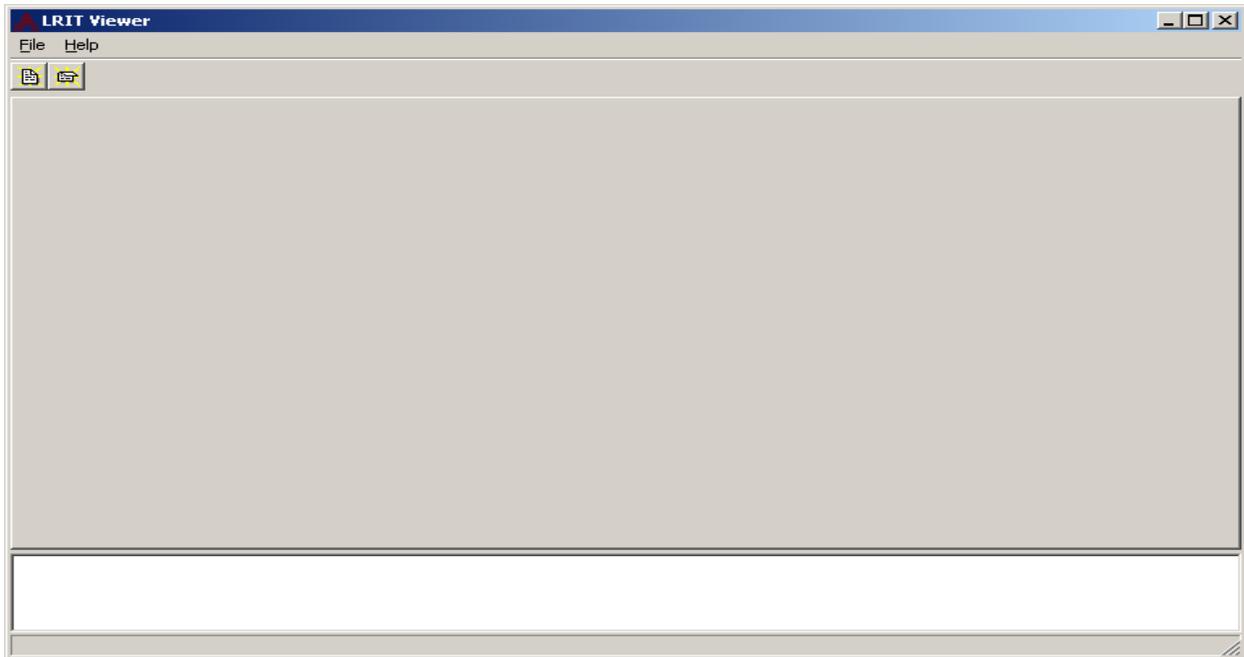
### 4.3 Logging Area

This area is fairly similar to the logging area in LritReceiver. It basically displays what files it is processing, and what is happening during processing. Below is a screen shot showing an example of what kind of messages are displayed.



## 5. LRITVIEWER

The LritViewer application is fun part of the suite. It allows you to view the contents of the LRIT files, whether they are text message or LRIT images. It is therefore the most complex application, in terms of the user-interface, of the Domain 6 suite. It can however be broken down into three rudimental areas: the Menu/Toolbar area, the Viewing area, and the Logging area. Here is a screen shot of LritViewer with no files open.



### 5.1 Menu/Toolbar Area

The Menu/Toolbar area is fairly simple. There isn't a set of configuration dialogs, or anything like that. The menu a small, simple set of options.

The File menu has the operations Open, Close, Print, and Exit. The Open option does exactly that, it allows you to open a LRIT file, by allowing you to select it from a file dialog box. The Close option closes a selected, open file. The Print option prints to the default printer. It does not let you select which printer at this time. The Exit option exits the program.

The Help menu has the About option, which opens the familiar dialog showing a little information about LritViewer.

The Toolbar has only two buttons. These buttons perform the menu options Open, on the left, and Close, on the right.

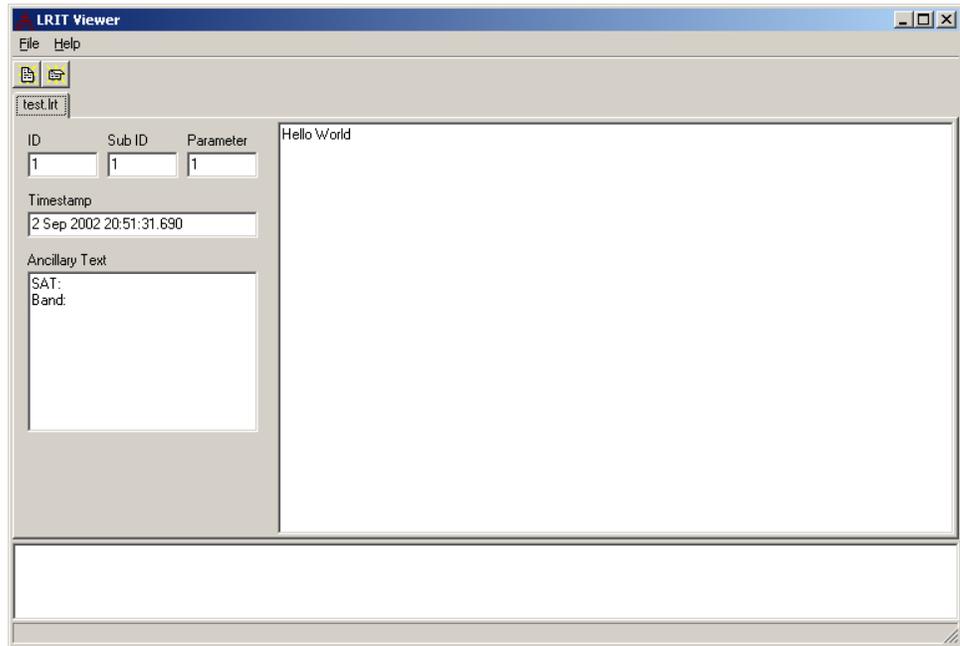


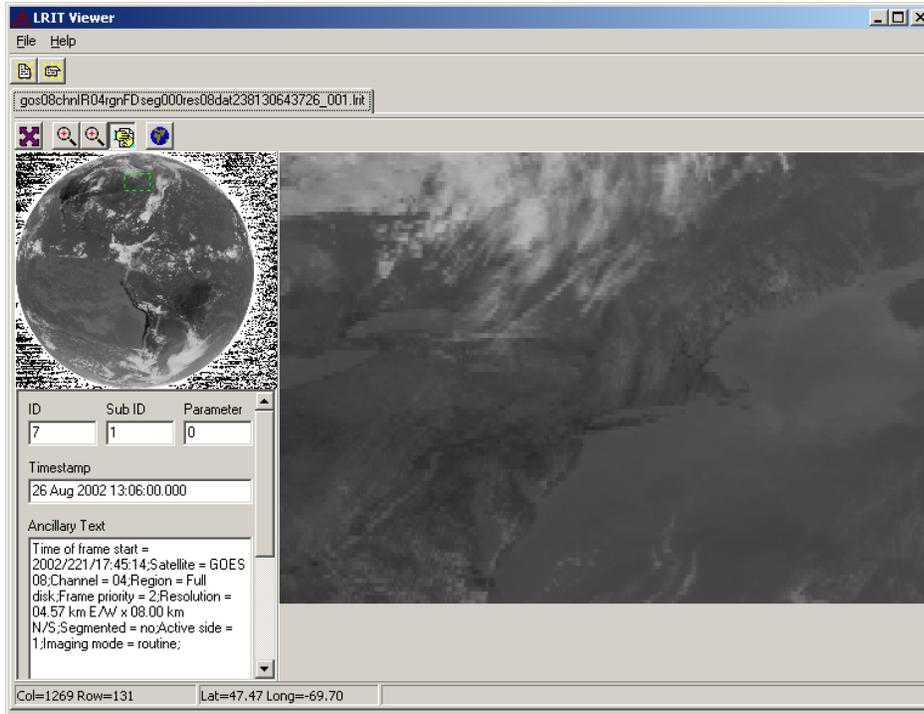
## 5.2 Viewing Area

The Viewing area is the most dynamic part of the program; depending on what you are doing, what type of files you are viewing, it may have different appearances. It will appear differently for text files than it will for images.

For both types of files, there is a Content area, and Information area. This is easily seen in viewing a text file.

You can easily see in this text file the two distinctive areas. On the left is the information area, giving you details such as the product information and the timestamp.





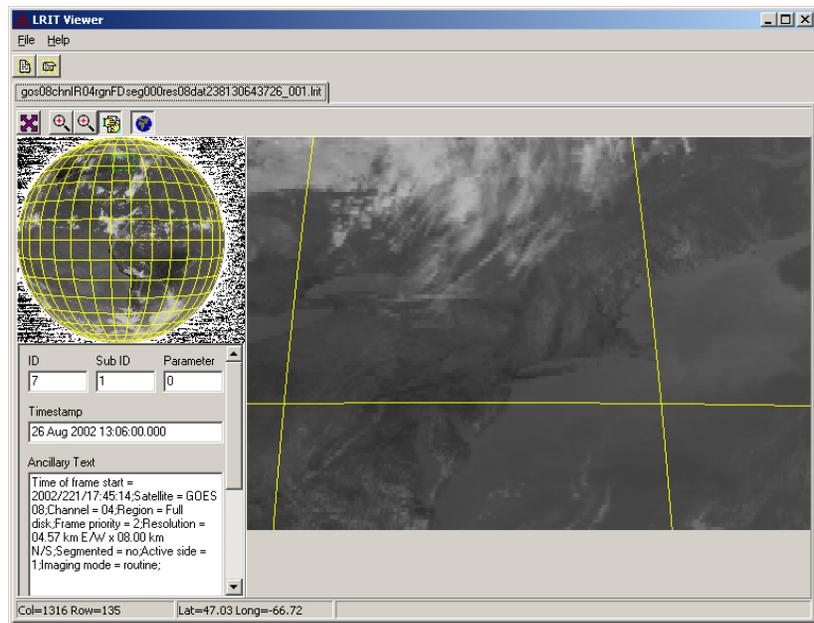
The information area is still present when dealing with image files, but there is also a Thumbnail area. You can see this in the upper-left corner in the screen shot to the left. You might also be able to see the green rectangle there, which displays the currently selected area. This allows you to zoom and pan, while giving you a reference of where you are in the image.

Another thing you might notice is a second toolbar for images. This allows you to change the viewing mode.

The first button sets the entire image as the viewing area. The second button, the first of two zoom tools, allows you to zoom over an area, while still maintaining the aspect ratio in the zoomed area. The second zoom tool, third button, does essentially the same thing. The only difference is that it does not lock the aspect ratio, so you can select any size rectangle. The fourth button is the pan tool. It lets you to move the view area to another part of the image.

The fifth, and final, button is the overlay button, and is an extremely interesting feature. This button allows you to overlay latitude and longitude lines at 10-degree intervals, if navigation information is provided. The screen shot to the right shows the same image as above, with overlay enabled.

Another thing that is worth mentioning briefly, as it is tied in with the overlay, is the Lat/Long coordinate display. If an image contains navigation data, when you mouse-over the image, the latitude and



longitude of the point the mouse cursor is on is displayed in the status bar. As you can see, when the screen shot was taken, the mouse was over 47.03 N, 66.72 W.

One thing that may be useful is to remember that each file is a child, its own window, of the entire LritViewer application. Now that window, that child, may be represented inside the viewing area as a tab, but you may also drag a tab outside the viewing area. You may also then “re-dock” a child back into the main window by dragging the file back into the main window.

### **5.3 Logging Area**

The Logging area is essentially the same as it is for all the other Domain 6 applications. It is just an area to display errors and warning messages. This will basically tell you if something is corrupt in the file, which may be an indication of an error during the receiving process. Under normal circumstances however, you will probably not see much in this area in the viewer.

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LRIT Domain 6 Version 1.0 was developed at Avtec Systems, Inc. A Chantilly, Virginia-based company, Avtec has provided aerospace and data communications solutions to government and industry since 1980.

Visit us online at [www.avtec.com](http://www.avtec.com)