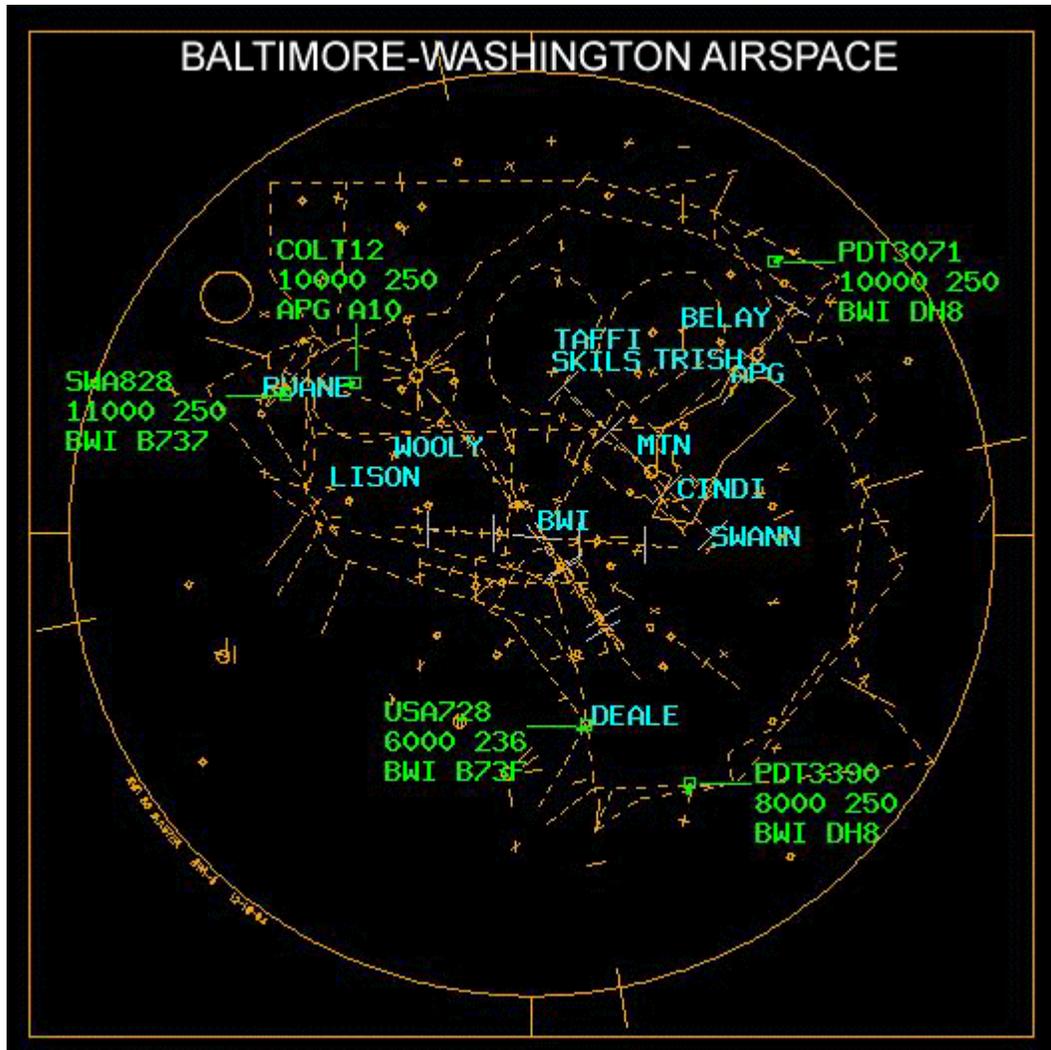


# XPVD DOCUMENTATION FOR THE TARGET GENERATION FACILITY (T G F)



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## APPENDIX A: Commands

# 1 INTRODUCTION

## 1.1 PURPOSE

The XPVD Interface Control Document (ICD) describes the interfaces between the Target Generator Facility Chassis and XPVD boxes.

## 1.2 ORGANIZATION

The TGF at the Federal Aviation Administration William J. Hughes Technical Center (FAA Technical Center) is managed by the System Simulation Support Branch, ACT-510, of the Aviation Simulation and Human Factors Division, ACT-500.

# 2 OVERVIEW

## 2.1 XPVD System Overview

The XPVD provides a graphical interface of the targets the TGF is creating. These flight plan targets are being used to create radar for the Technical Center ATC Laboratories. Figure 2-1 shows a general overview of the major components of TGF.

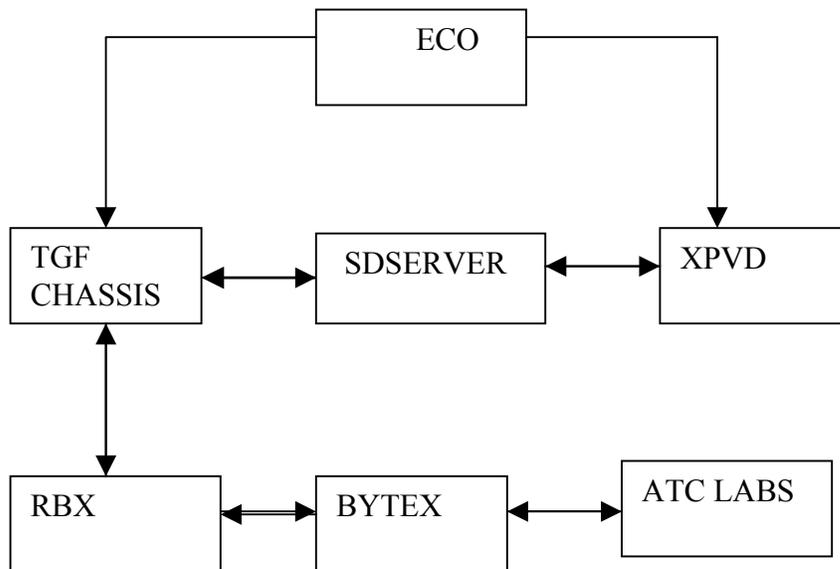


Figure 2.1-1 TGF Target Generation Synopsi

## 2.2 XPVD Interfaces

The following XPVD interfaces will be described in this document:

- User interface

This interface describes the actions that a programmer, controller, or simulation pilot would use while working with XPVD.

- SDSERVER interface

The SDSERVER serves the XPVD workstation with flight data generated by the TGF chassis.

- Simulation Pilot Workstation (SPW) interface

This section describes the communication interface between the Exercise Control Operator (ECO) and the SPWs.

## **2.3 XPVD Hardware**

XPVD can run on three different hardware platforms.

- One of the hardware platforms is 100 or 120 Megahertz Pentium personal computers running the Linux operating system. In addition, the Pentium Pro 200 fits into this group of hardware.
- Another set of hardware platform is in our PRM lab. This room has Sony 2048 X 2048 pixel displays that plug into Pentium Pro 200 Personal Computers or Sun workstations running Solaris. If need be, XPVD could probably run on a Pentium 75 running Solaris. It also runs on IBM RISC running AIX.
- The last set of hardware consists of Silicon Graphic computers running Irix.

## **3 XPVD User Interface**

### **3.1 Getting Started**

Find an XPVD workstation and logon as XPVD, password: xpv.

Slide the mouse on XPVD and then choose the desired airspace map.

Select the TGF menu icon and click “specify”.

Click on the chassis the simulation is running on.

Click “OK”

Select the TGF menu icon and click “connect”.

As soon as the simulation has begun, targets appear on the XPVD screen.

### 3.2 Exiting XPVD

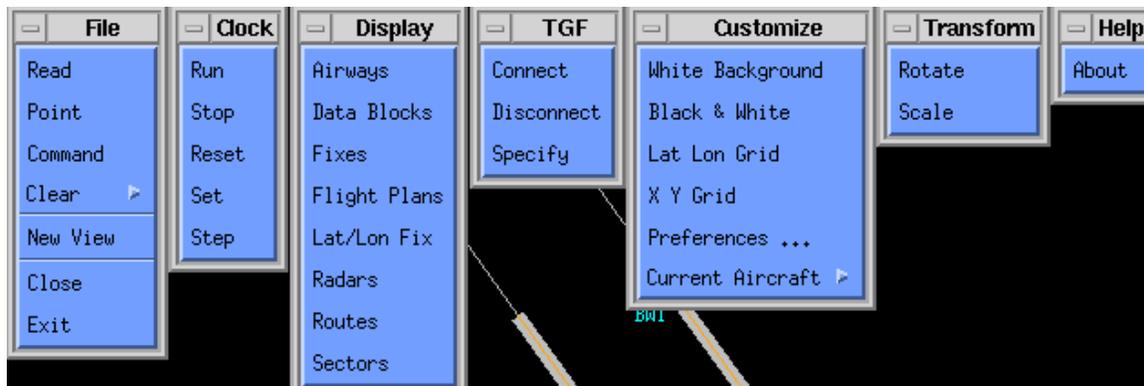
Select the FILE Menu icon and click the mouse on “exit”.

### 3.3 Summary of XPVD Commands

The XPVD display consists of seven main menus including the Help menu. The seven menus are:

- **File,**
- **Clock,**
- **Display,**
- **TGF,**
- **Customize,**
- **Transform, and Help.**

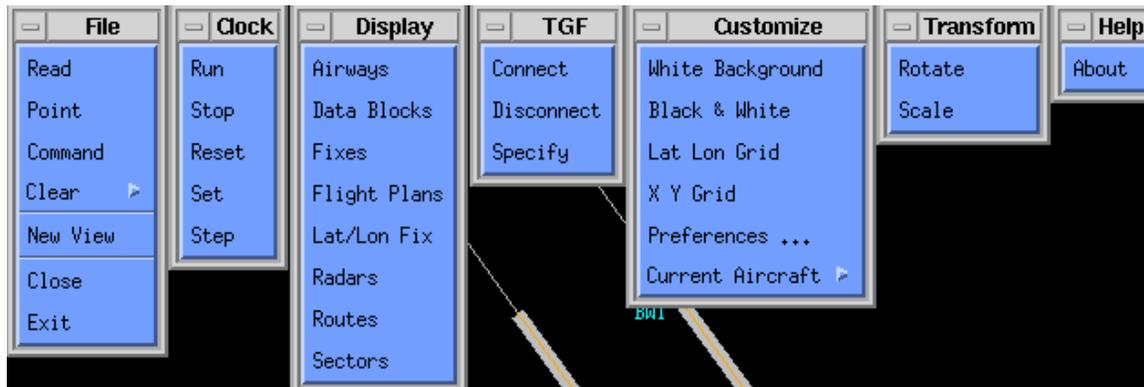
Figure 3.3-1 Summary of the XPVD Commands



#### 3.3.1 FILE Menu

The submenus of the **File menu** are Read, Point, command, Clear, New View, Close, and Exit. See the figure below.

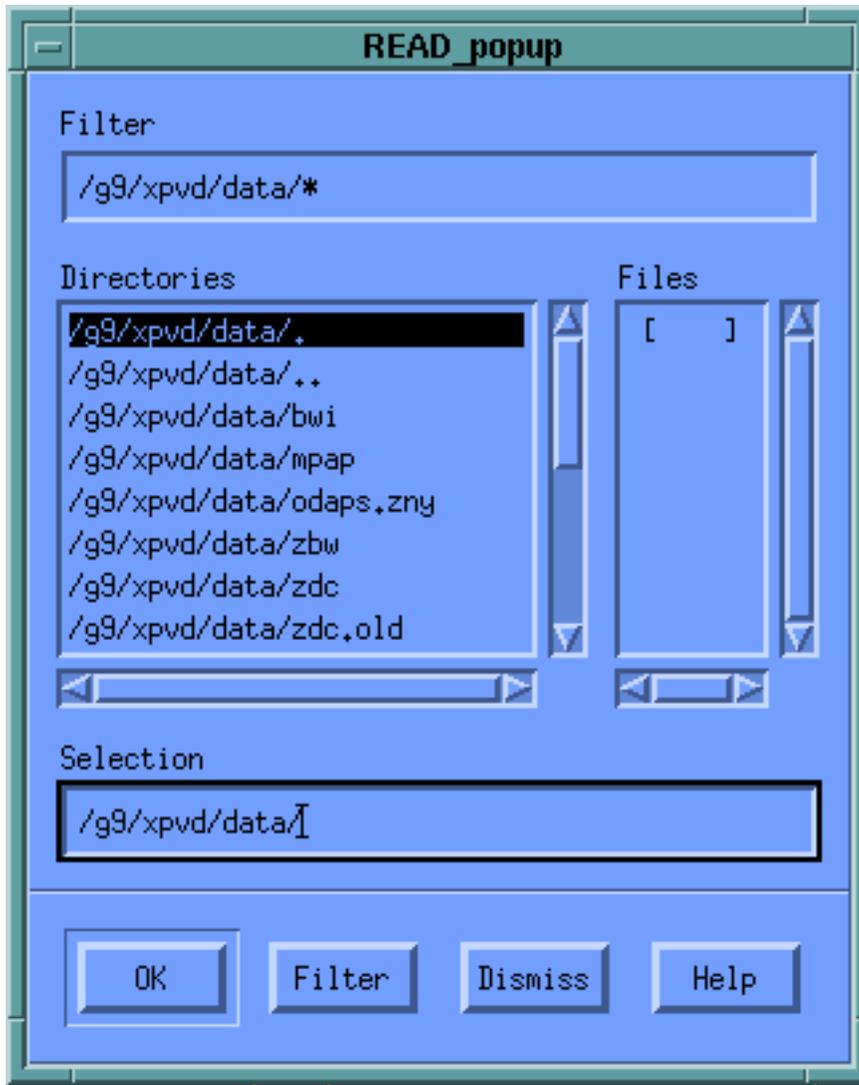
**Figure 3.3-2 XPVD Main menu – File Sub-menu**



### 3.3.1.1 Read

The **READ** menu, shown below is used to ‘read in’ the specific file containing the specific map details and all static data. Normally this file is read in automatically when the **XPVD** screen is brought up together with a specified argument.

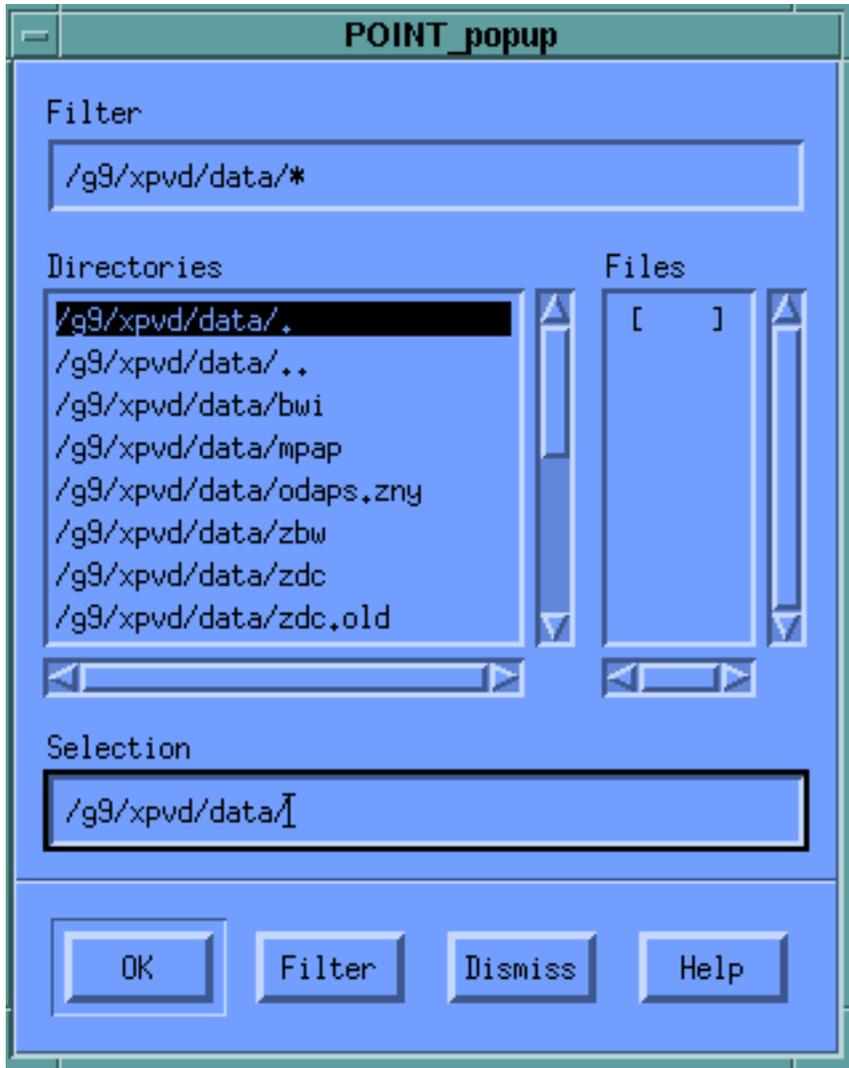
**Figure 3.3-3 Read Pop-Up from File Menu**



### 3.3.1.2 Point

The POINT\_popup uses dynamic data and its data is always time-stamped. The "POINT" files are always used in conjunction with pre-recorded playback.

**Figure 3.3-4 POINT POP-UP FROM FILE MENU**



### 3.3.1.3 Command

The command pop-up menu is used to enter commands directly into the XPVD. A case in point is fix entering. The command to display a fix is as follows:  
FIX APG LL 392830.0 761030.0,  
followed by the command:  
DISPLAY FIX APG

**Figure 3.3-5 COMMAND POP-UP FROM FILE MENU**



### 3.3.1.4 Clear

The Clear submenu and sub-submenus will clear all the graphics from the submenus shown in its pull down menus.

**Figure 3.3-6 CLEAR POP-UP FROM FILE MENU**



### 3.3.1.5 New View

The remaining submenus within the File menu are trivial. One of these sub-menus is New View. New View gives you an empty new window.

### 3.3.1.6 Close

The Close sub-menu closes the current window but does not exit the XPVD application.

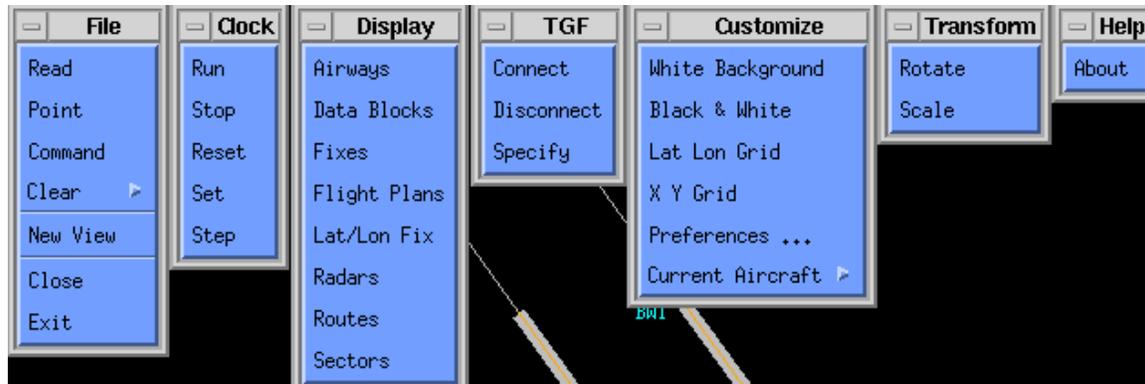
### 3.3.1.7 Exit

The Exit sub-menu shuts down the XPVD application completely.

### 3.3.2 CLOCK Menu

The Clock menu controls the XPVD clock and is used for pre-recorded data. It is shown in the main display below.

**Figure 3.3-7 XPVD Main menu – Clock Sub-menu**



The Clock menu is shown below.

**Figure 3.3-8 CLOCK POP\_UP Menu**



#### 3.3.2.1 Run

**RUN** starts the clock.

#### 3.3.2.2 Reset

**RESET** sets the clock to **24:00:00**.

### 3.3.2.3 Set

**SET** gives you the opportunity to arbitrarily set the clock at any desired time within the limits of the pre-recording.

**Figure 3.3-9 SET CLOCK POP-UP MENU**



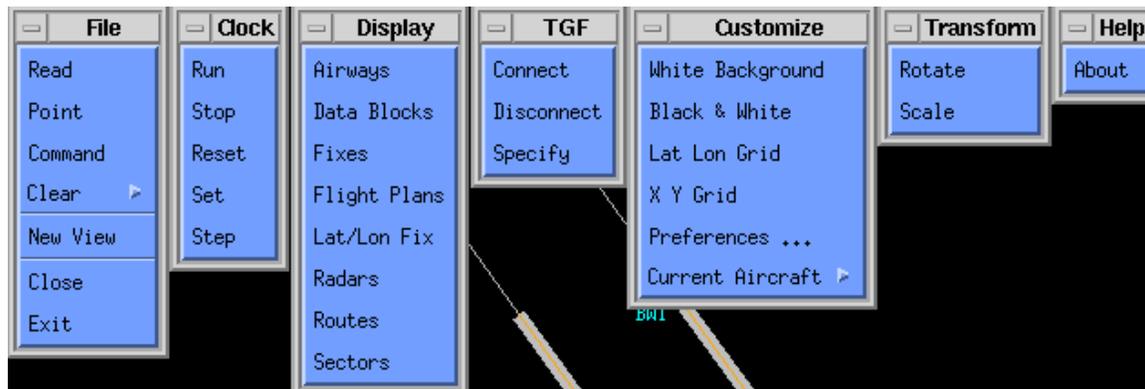
### 3.3.2.4 Stop

**STOP** terminates the clock.

### 3.3.3 DISPLAY Menu

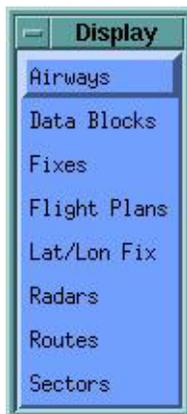
The DISPLAY menu consists of 8 sub-menus, which may or may not have their own menus. The Display menu is shown below from the main XPVD panel.

Figure 3.3-20 XPVD Main menu – Display Sub-menu



#### 3.3.3.1 Airways

The AIRWAYS menu will contain all the airways in the particular simulation exercise currently running. If there are none it will be indicated by an appropriate dialog pop-up. Any airway of interest can be chosen from the AIRWAYS submenu.



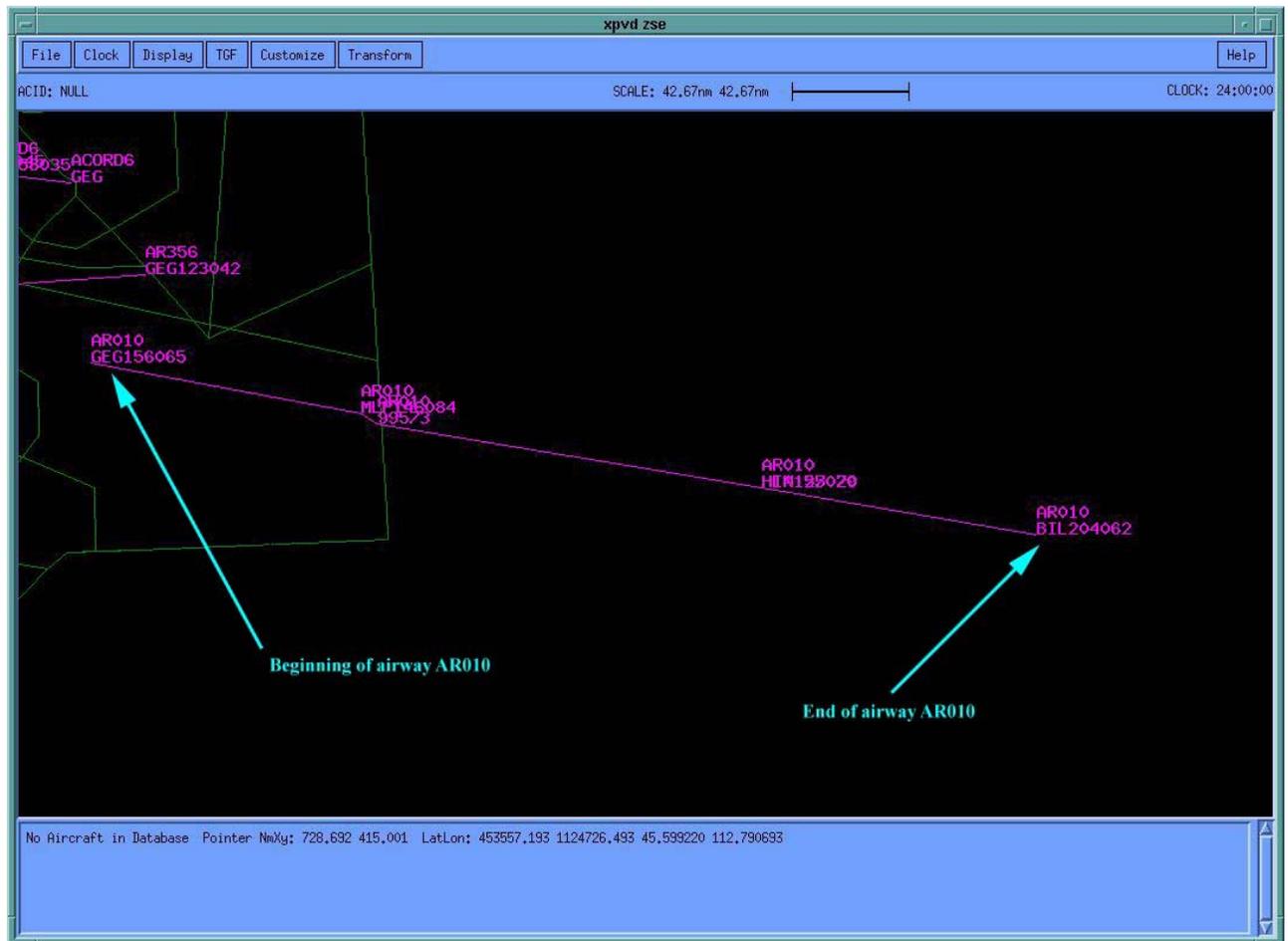
Here AR010 is selected as shown.

**Figure 3.3-13 Display Menu – Airways Chosen**



Below, the selected airway is shown with its fixed radial distances (FRD) depicting starting and ending points.

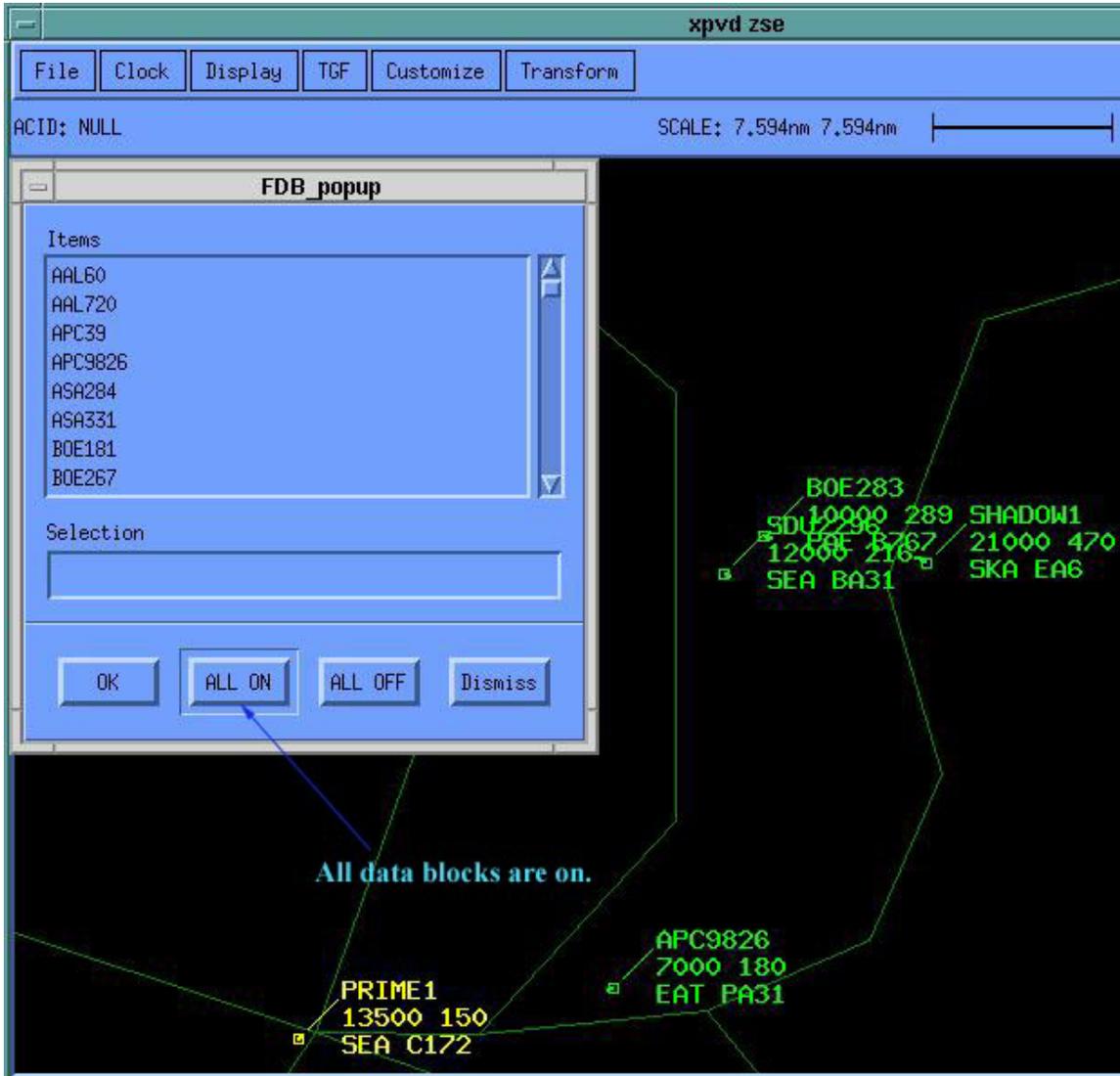
**Figure 3.3-12 AR010 Airway is shown**



### 3.3.3.2 Data Blocks

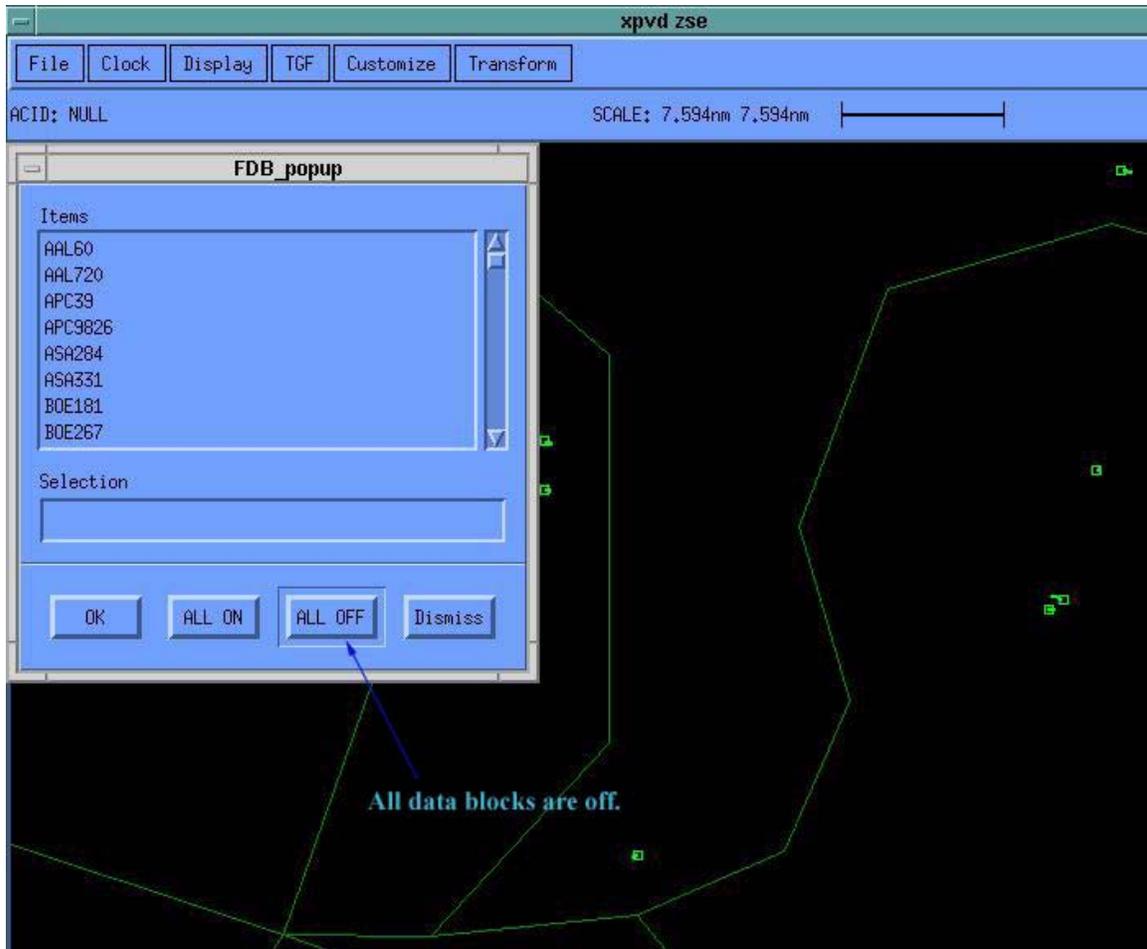
The Data Blocks menu enables and disables the aircraft's data blocks. An example best illustrates this function. The figure below shows a sample of airspace with the data blocks turned on.

Figure 3.3-13 Data Blocks turned on



The figure below shows a sample of airspace with the data blocks turned off.

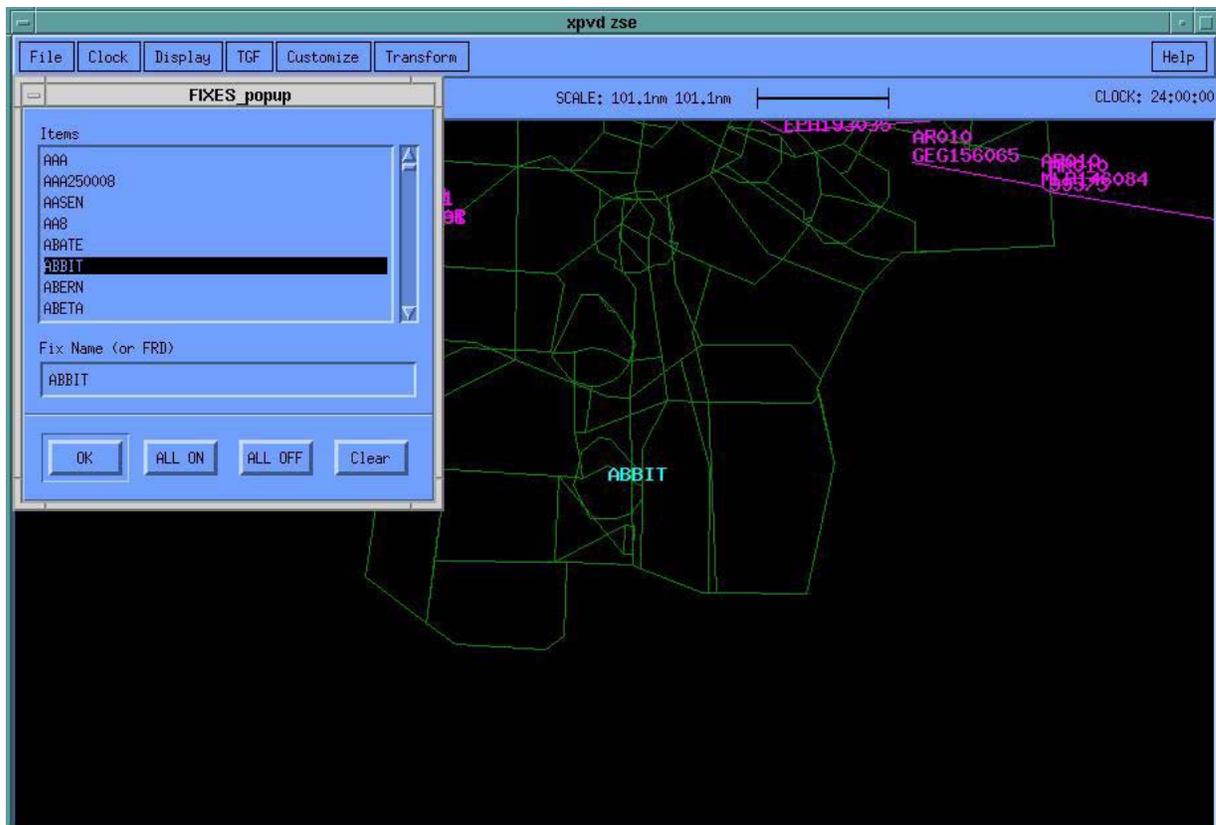
**Figure 3.3-14 Display Menu – Data Blocks turned off**



### 3.3.3.3 Fixes

The FIX submenu contains all the fixes in the current exercise. Each fix when chosen will be able to be placed on the map according to its latitude and longitude coordinates. In the example below, fix ABBIT is chosen in the pop-up menu and displayed on the XPVD screen.

**Figure 3.3-15 Display Menu – Fix Sub-Menu with Fix ABBIT chosen for display**



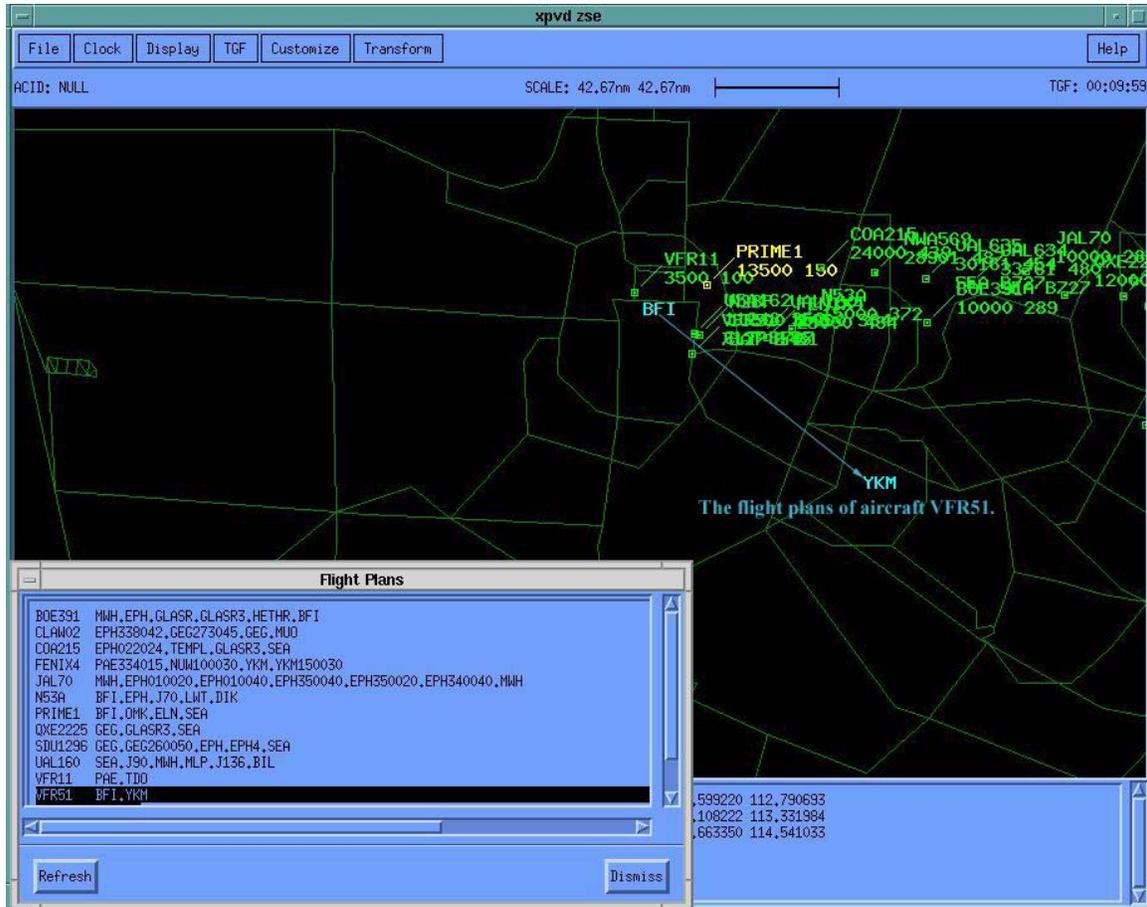
### 3.3.3.4 Flight Plans

The Flight Plan submenu of the Display main menu gives all the flight data of each aircraft in the scenario. All aircraft data are in the form of fixes consisting of departure and arrival fixes and intermediate fixes if they are present, and presented in the popup in alphabetical order. To search through the database after a particular aircraft, use the scroll bar on the right of the

popup window. Select the flight plan of interest and then XPVD will graphically display its flight plan. When finished use the 'Dismiss' button.

An example of the Flight Plan popup menu is shown below.

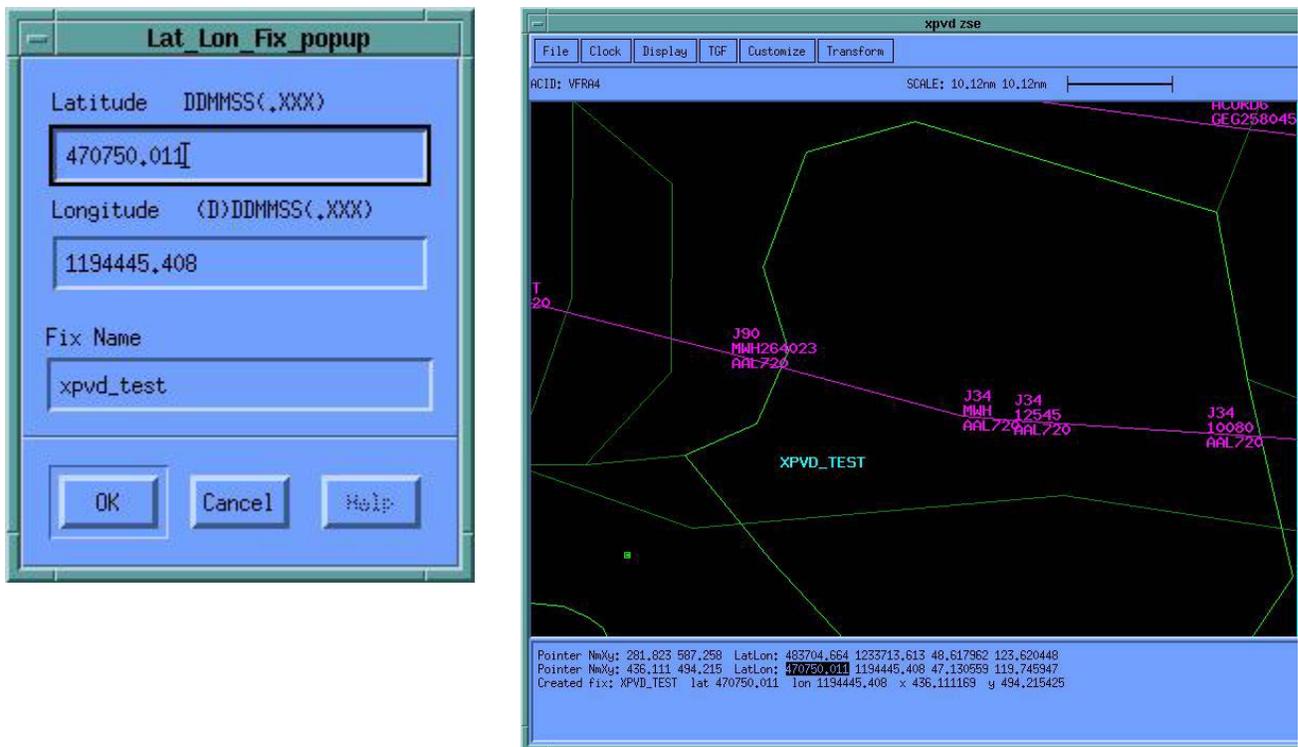
**Figure 3.3-16 Flight Plan Submenu of Display Main menu – Flight VFR51 is displayed.**



### 3.3.3.5 Lat/Lon Fix

The submenu Lat\_Lon\_Fix\_popup of the Display menu gives one the possibility to enter a new fix into the simulation with the knowledge of the latitude and longitude. These values must be given in the format shown accompanied by a name of that particular fix. . In the example the fix name is XPVD\_TEST and at the bottom of the screen are the latitudes and longitudes written out.

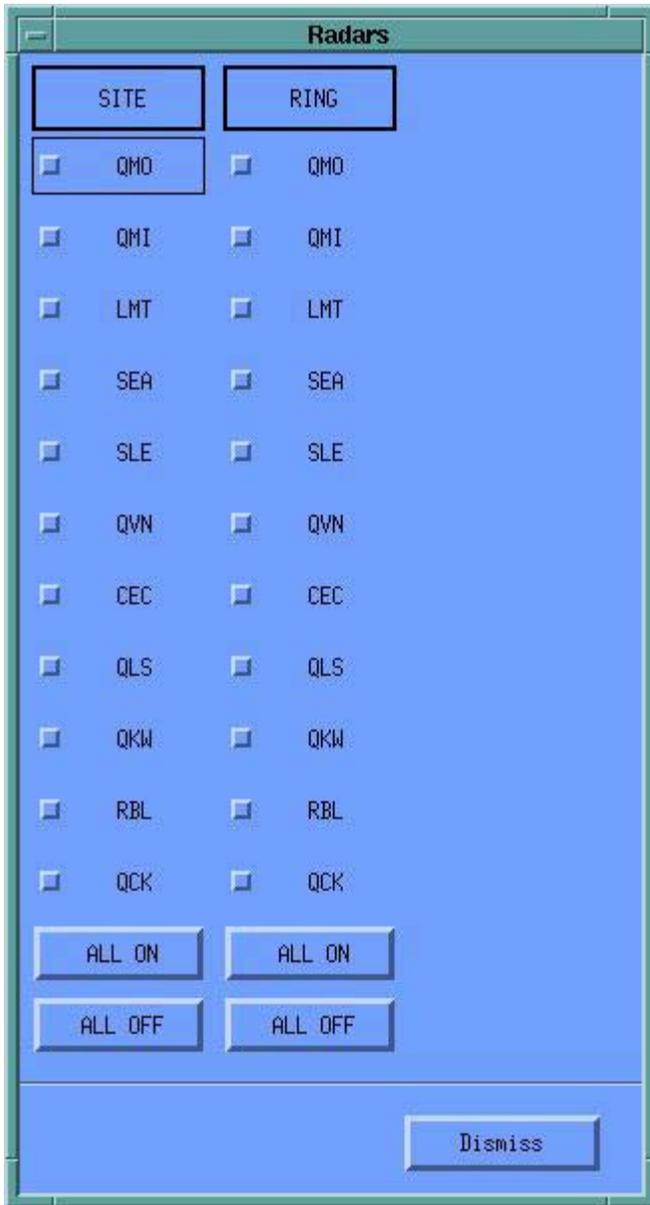
Figure 3.3-17 Lat/Lon Fix shown



### 3.3.3.6 Radars

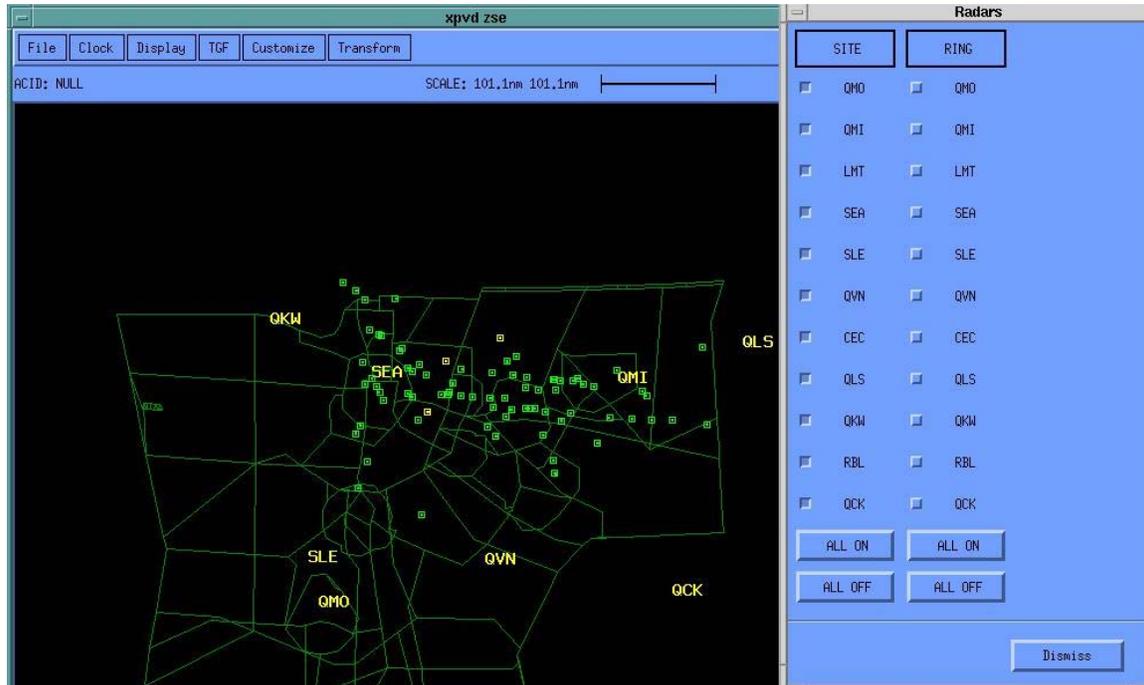
The RADAR submenu of the Display menu consists of two columns. The first column consists of all the names of the radar sites participating in the scenario. The second column consists of the corresponding rings of each radar site.

**Figure 3.3-18 Radar pop-up menu from Display sub-menu**



The diagram below displays 8 selected radar sites.

**Figure 3.3-19 Radar sites displayed.**



This diagram displays the ring around chosen radar sites. This ring or halo defines the radar reach for each defined radar site.

**Figure 3.3-20 Radar rings are displayed**



### 3.3.3.7 Routes

The next submenu in the **Display** menu section is the **Routes** menu. All routes that are in the database and associated with an aircraft will be found and displayed when called upon. Click on the name of the aircraft as shown below. The name will appear in the 'Selection' portion of the dialog box. Click 'OK' and that route will appear on the XPVD screen as shown in the same figure. Below is the route for QXE322. It will fly airway V120 starting at fix EAT and ends at fix GEG.

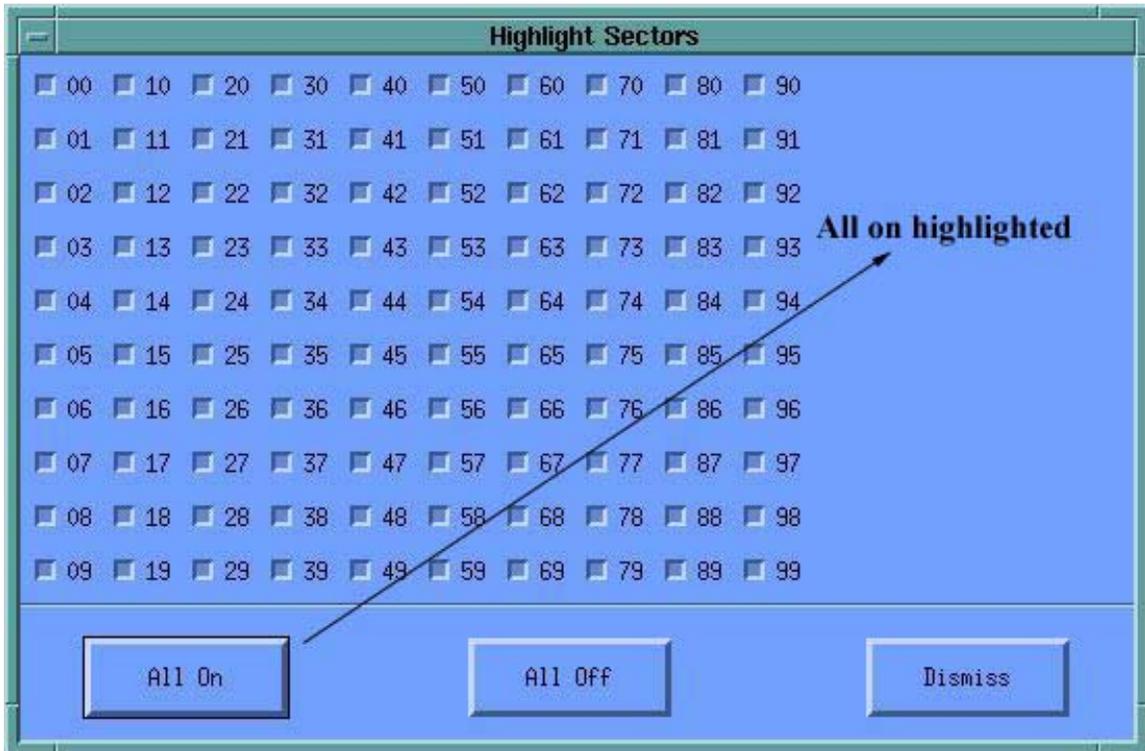
**Figure 3.3-21 Route for aircraft QXE322 is displayed**



### 3.3.3.8 Sectors

The last submenu of the **Display** menu is the **Sector** menu. Below is the Highlight Sectors menu which enables certain sectors to be more highlighted than others depending upon the selection.

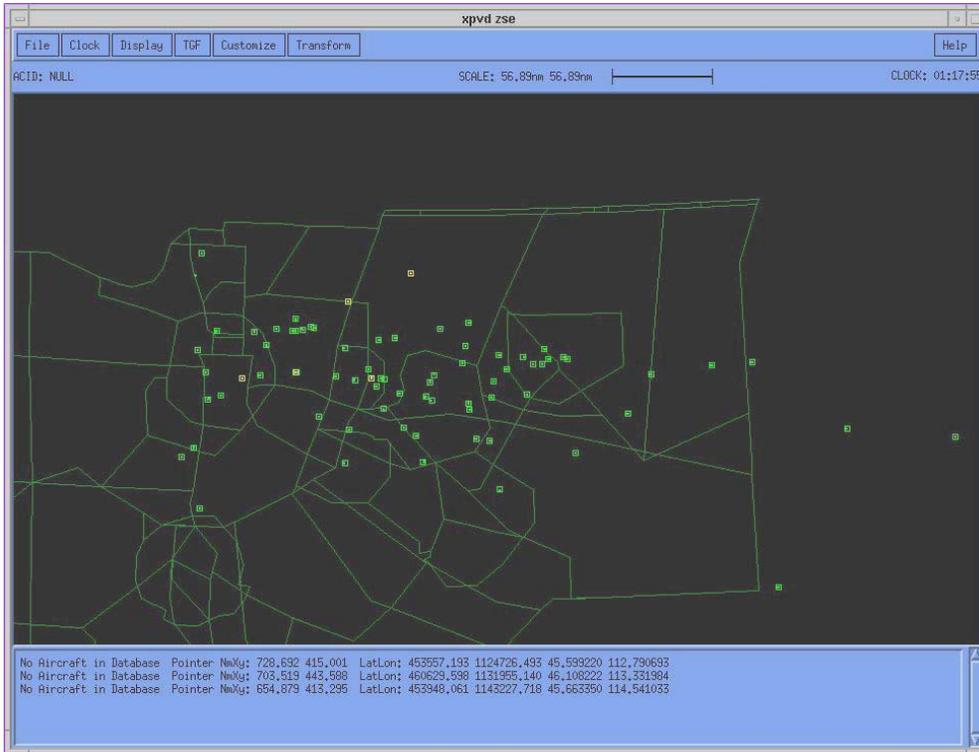
Figure 3.3-22 Sectors Submenu of Display menu



**Figure 3.3-23 Selected Sectors are highlighted**



**Figure 3.3-24 Highlight has been turned off**



### 3.3.4 TGF Menu

#### 3.3.4.1 Connect

Connect will enable the XPVD application to connect to the specific tgf chassis chosen in the “Specify” submenu. See Specify below.

#### 3.3.4.2 Disconnect

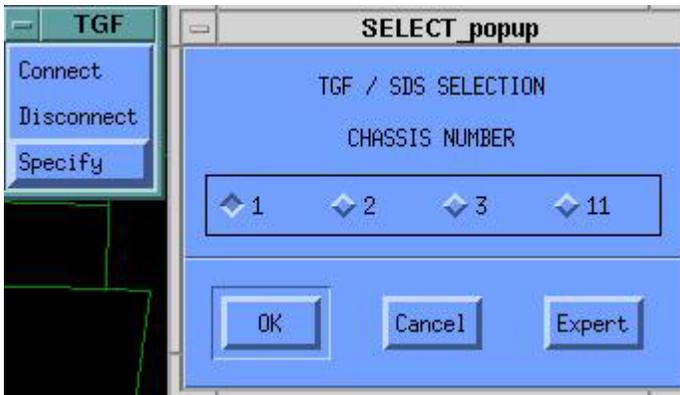
Disconnect will disable the connection between the tgf chassis and the XPVD application.

#### 3.3.4.3 Specify

##### 3.3.4.3.1 Normal XPVD Runs

The first job of the XPVD operator is to Specify and Select the tgf chassis with which the simulation is taking place on. First, click the specify selection. The select pop-up sub-menu will appear. Then click on the chassis that the simulation is running on. Click “OK”. See the diagram below.

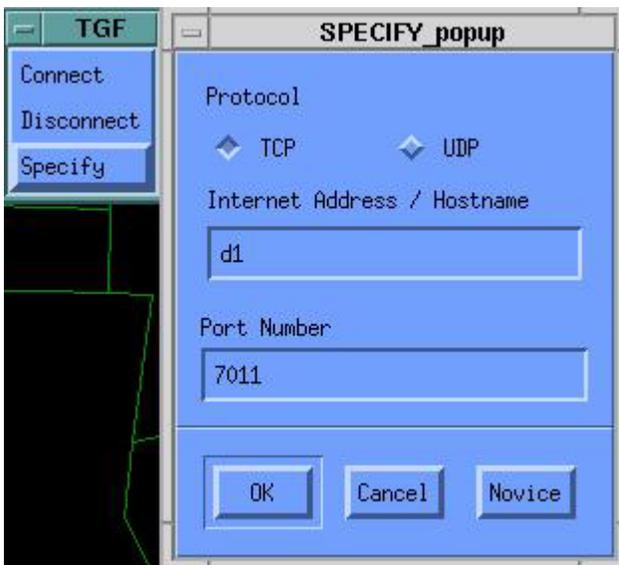
**Figure 3.3-25 Choose a chassis at start-up**



### 3.3.4.3.2 Advanced Programming XPVD Runs

The Expert brings up a dialog box so that the user can enter the appropriate SDS server machine name and its port number. In the figure below, the SDS server name is d2 and port number 7011 is used for communication.

**Figure 3.3-26 Expert Specifying**



### 3.3.5 Customize Menu

The Customize menu from the main menu is displayed below.

**Figure 3.3-27 The Customize Menu**



#### 3.3.5.1 White Background

The White background switches the normal background of black to white.

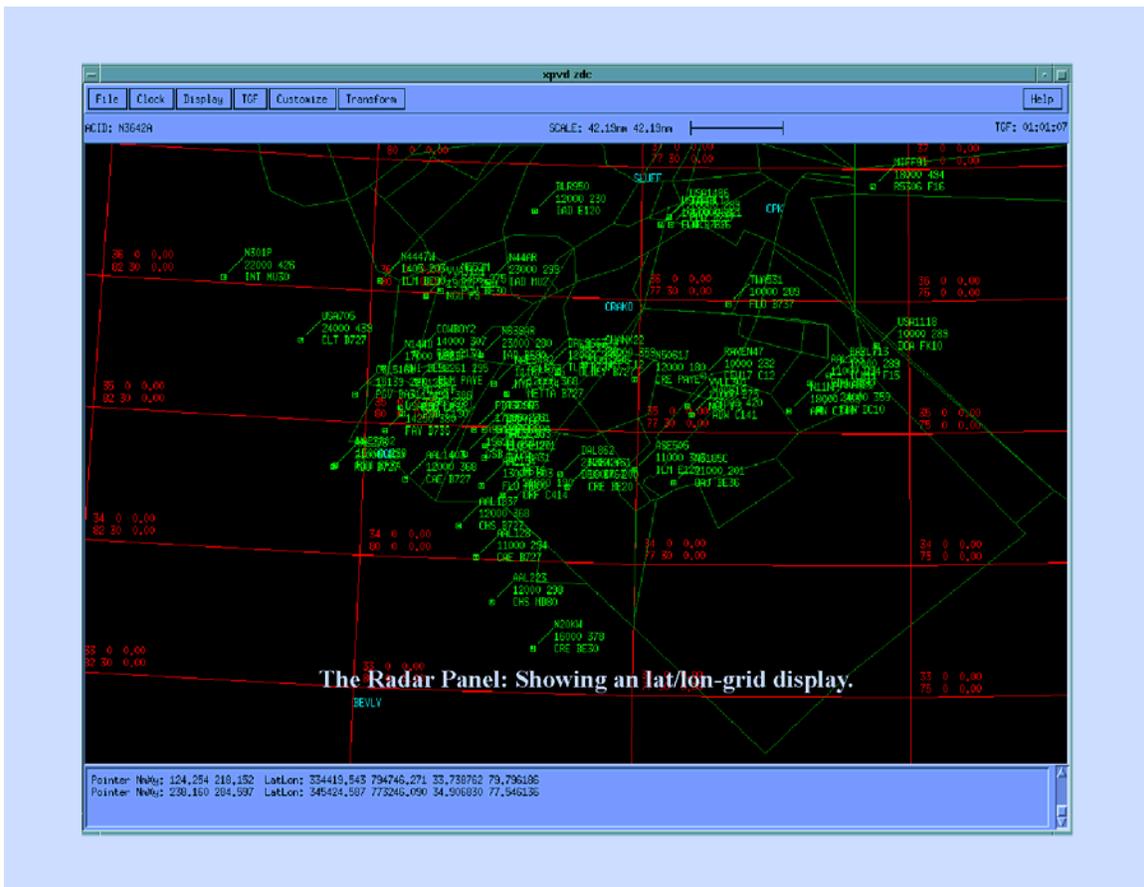
#### 3.3.5.2 Black & White

Converts the normal "color" representation to black and white.

### 3.3.5.3 Lat/Lon Grid

The Lat/Lon Grid is depicted in the figure below. It places a rectangular grid over the entire XPVD display showing the latitudes and longitudes at each intersection displayed.

Figure 3.3-28 Latitude/Longitude Grid is displayed





### **3.3.5.5 Preferences**

The Preferences submenu of the Customize menu contains numerous controls to enable the user to abstract specific data pertinent to the project at hand. See the Preferences Menu on the next page.

#### 3.3.5.5.1 Mouse Preferences

The Mouse button when clicked enables the standard mouse resident within the system or it enables the simulation operators' mouse.

#### 3.3.5.5.2 FONT Preferences

The Font menu enables/disables the following fonts:

- 5 X 7
- 6 X 10
- 7 X 13
- 8 X 13 bold
- 9 X 15 bold
- 10 X 20
- 12 X 24

#### 3.3.5.5.3 Clock Rate Preferences

The Clock Rate (in seconds) menu gives the time if other than one second that the clock is incremented. An example of a 6 seconds rate is that every 6 seconds the clock is updated.

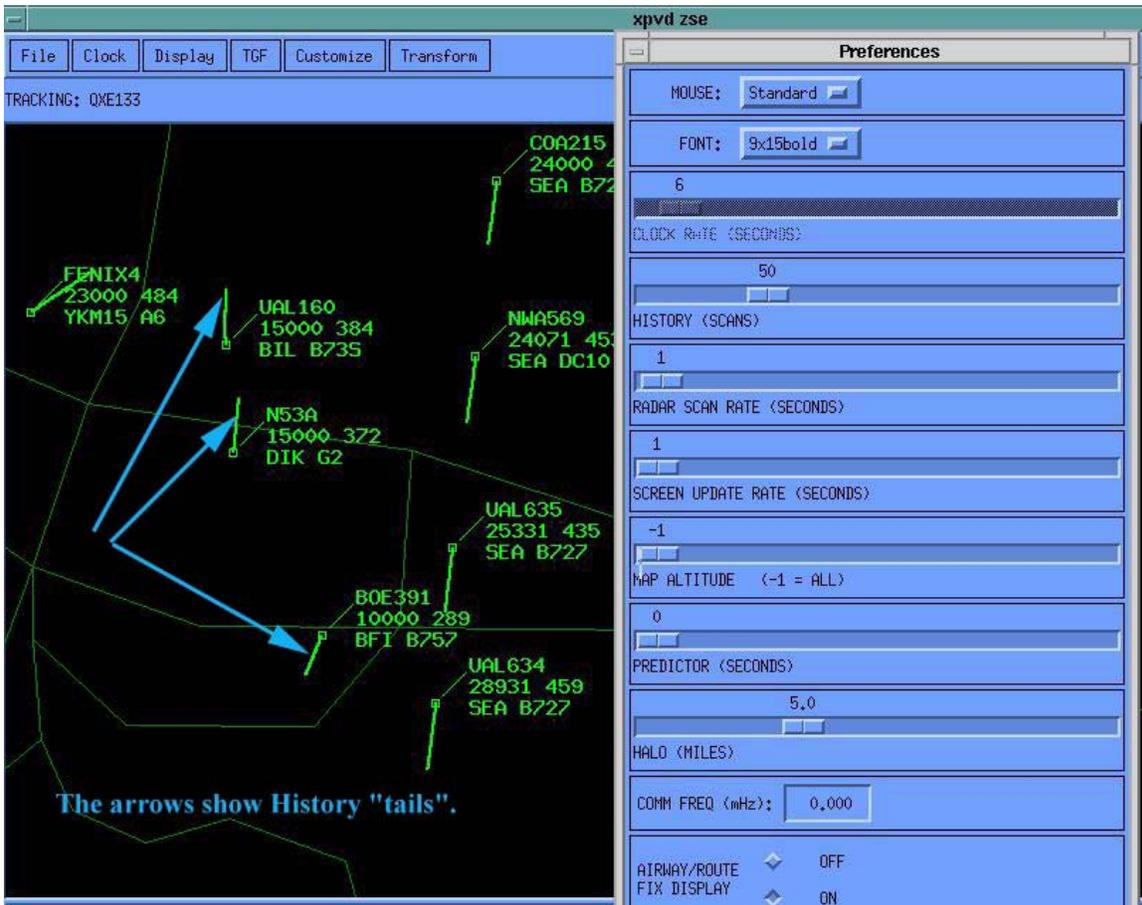
**Figure 3.3-30 Preferences Submenu of Customize Menu**

MOUSE:	Standard
FONT:	9x15bold
6	<input type="text"/>
CLOCK RATE (SECONDS)	
15	<input type="text"/>
HISTORY (SCANS)	
1	<input type="text"/>
RADAR SCAN RATE (SECONDS)	
1	<input type="text"/>
SCREEN UPDATE RATE (SECONDS)	
-1	<input type="text"/>
MAP ALTITUDE (-1 = ALL)	
0	<input type="text"/>
PREDICTOR (SECONDS)	
5.0	<input type="text"/>
HALO (MILES)	
COMM FREQ (mHz):	0,000
AIRWAY/ROUTE	◆ OFF
FIX DISPLAY	◆ ON
<input type="button" value="Dismiss"/>	

### 3.3.5.5.4 History Preferences

History (scans) menu places a “tail” at the end of the target. The length or “time” is the number of scans indicated on the sliding bar when moved with the mouse. See the diagram below for further explanation

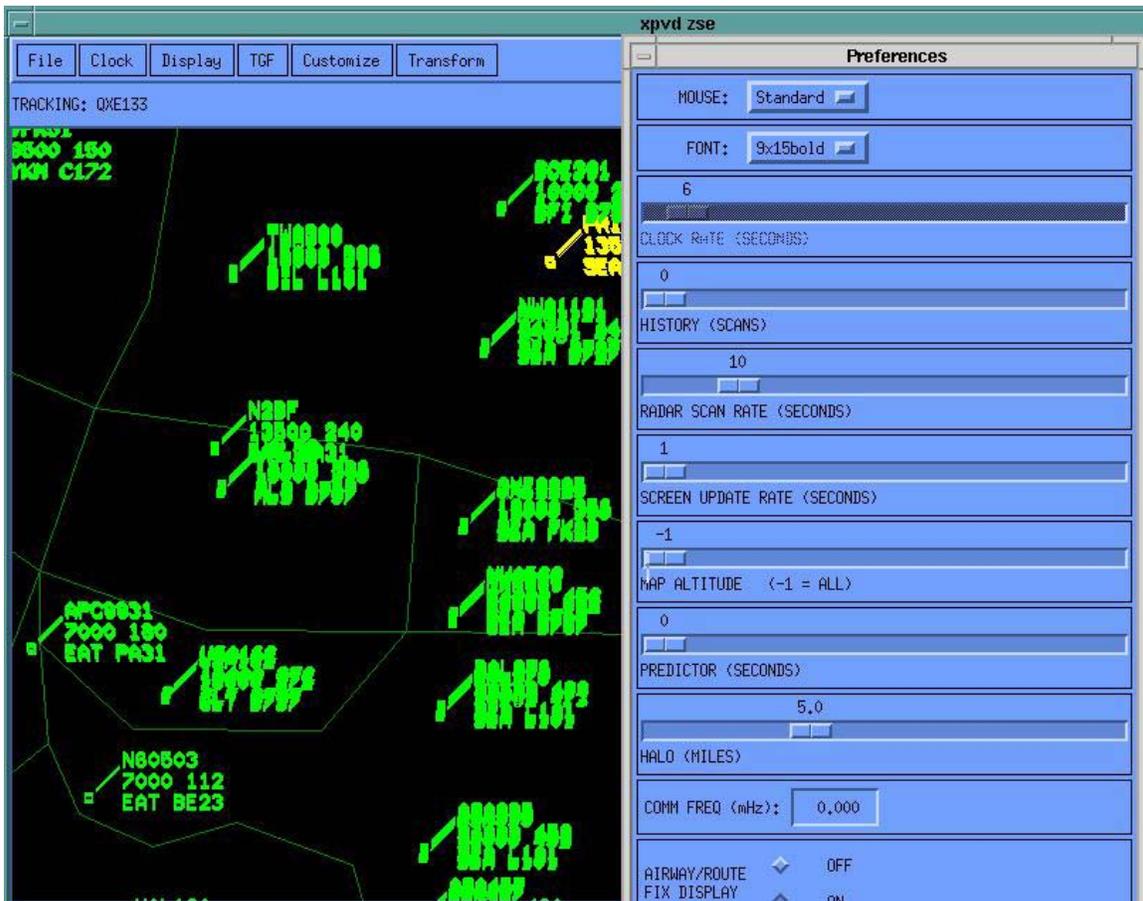
**Figure 3.3-31 History “tails” set at 50**



### 3.3.5.5.5 Radar Scan Rate (Seconds) Preferences

Radar Scan Rate (seconds) indicates how many radar sweeps per second is represented on the XPVD screen. See the figure below. Notice how blurry the image appears with a Radar Scan Rate of 10. This rate of 10 should be used with pre-recorded data.

**Figure 3.3-32 Radar Scan Rate Preferences displayed**



### 3.3.5.5.6 Screen Update Rate Preferences

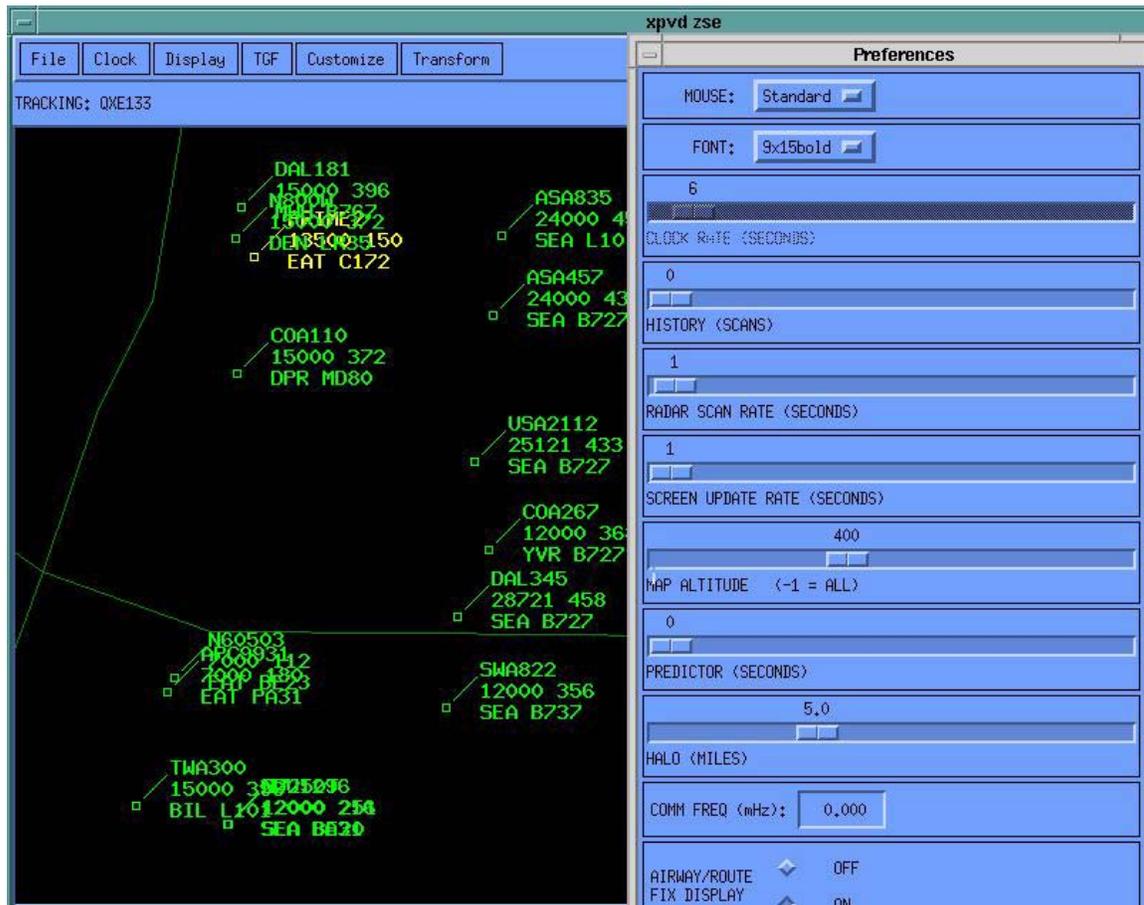
Screen Update Rate (seconds) indicates how many seconds before the XPVD screen is updated. A 5 seconds update means that after 5 seconds all positions will remain still until the fifth second. At the fifth second the aircraft positions are updated on the XPVD screen.

### 3.3.5.5.7 Map Altitude Preferences

Map Altitude shows the physical view of the sectors' altitude. Compare the history tail figure and the Map altitude figure below. Notice the lack of lines and detail between the two diagrams.

The map altitude in the figure below is set to 400. In reality, this number is 400 times 100 feet or 40,000 feet. Therefore the diagram below is looking at the same area 40,000 feet above the ground. At this distance notice how sectors are eliminated from the view. Note that a setting of "-1" indicates that all sectors are shown.

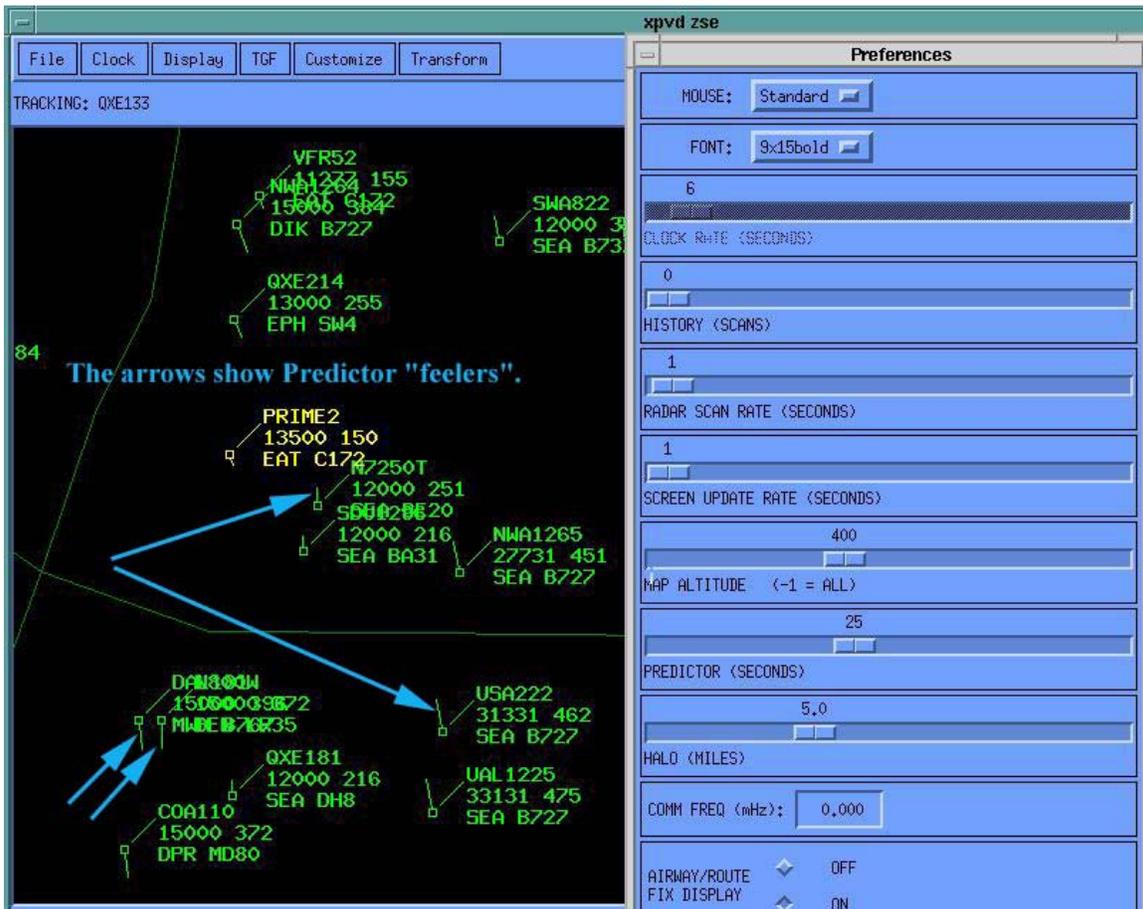
**Figure 3.3-33 Map Altitude is set to 400**



### 3.3.5.5.8 Predictor Preferences

The Predictor (seconds) sets a “stinger” before the target to indicate how many scans before the target reaches a specific area. The stinger in the diagram below is set to 25 and therefore, the stinger shows where the aircraft will be in 25 seconds from now.

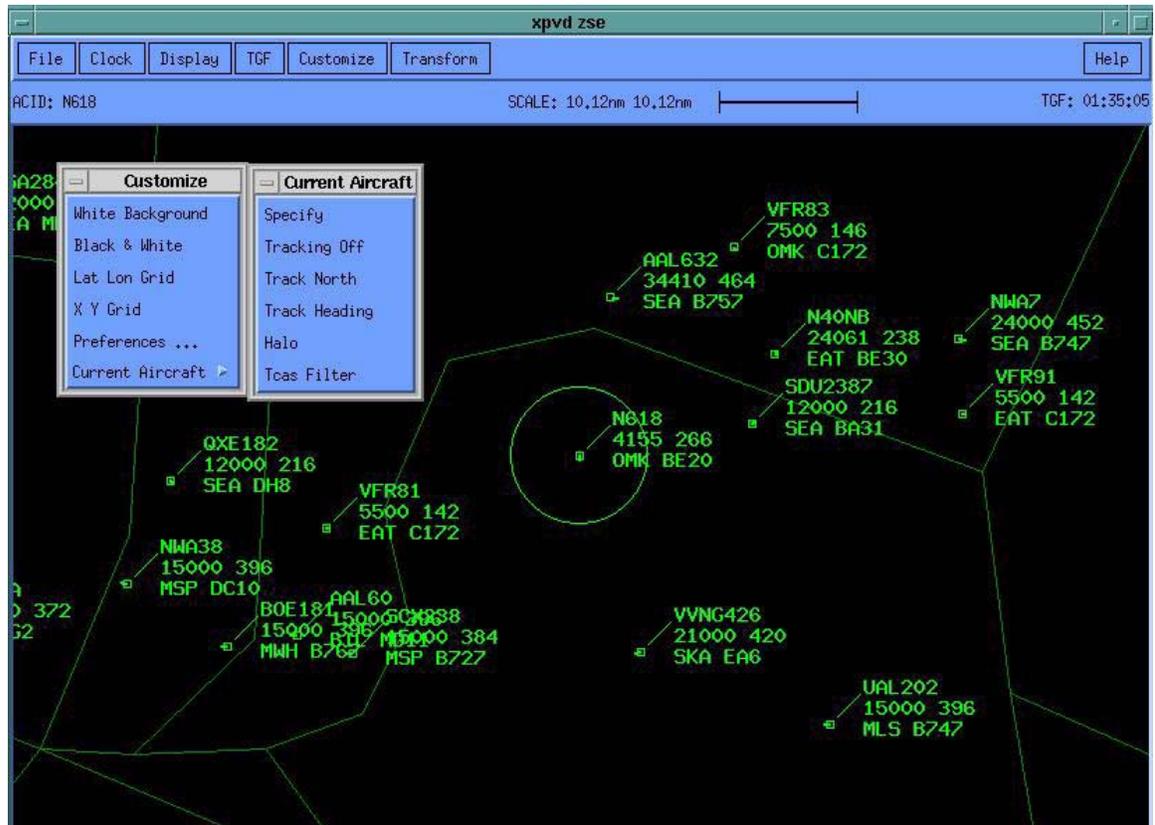
Figure 3.3-34 Predictor “stinger” preference is set to 25



### 3.3.5.5.9 Halo Preferences

The Halo is at setting 5.0. This means that the ring around an aircraft is set at 5 miles. See the halo associated with aircraft N618 in the diagram below.

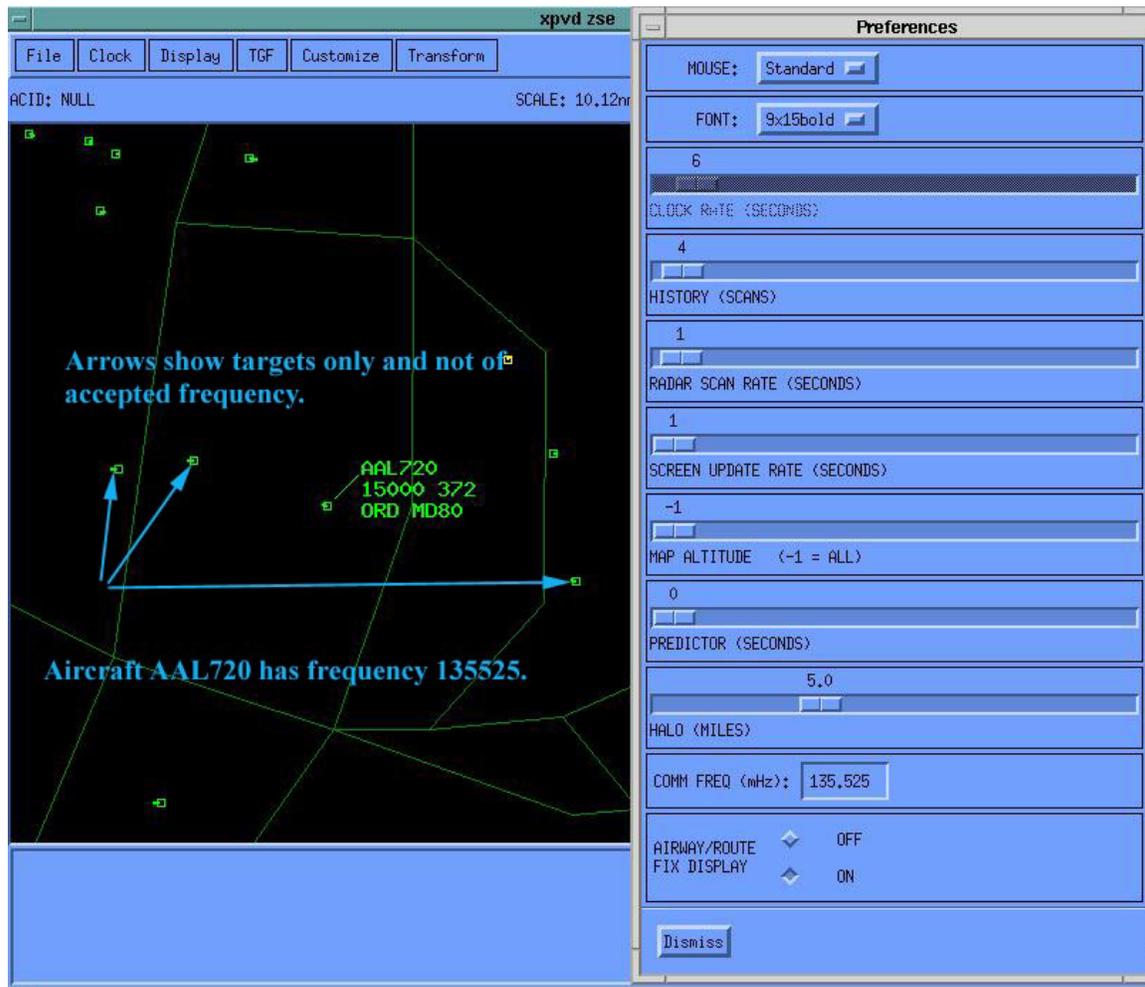
**Figure 3.3-35 Halo Preference displayed**



### 3.3.5.5.10 Comm Freq Preferences

The Comm Freq, (Communication Frequency), if entered will enable the controller to filter out all traffic not on that particular frequency. Traffic of other frequency will appear as small targets without data blocks. If zeros are entered then all traffic is shown. As an example below, a frequency of 135.525 was entered. Only the aircraft with that frequency appears with its full data block. All other aircraft appear as targets. See the figure below.

**Figure 3.3-36 Communication Frequency Preferences displayed**



#### 3.3.5.5.11 Airway/Route Fix Display Preferences

In order to display airway routes and fixes, click the on button.  
To suppress viewing airway routes and fixes, click the off button.

#### 3.3.5.5.12 Dismiss

Clicking on “dismiss”, removes the Preferences submenu of the Customize menu.

### 3.3.5.6 Current Aircraft

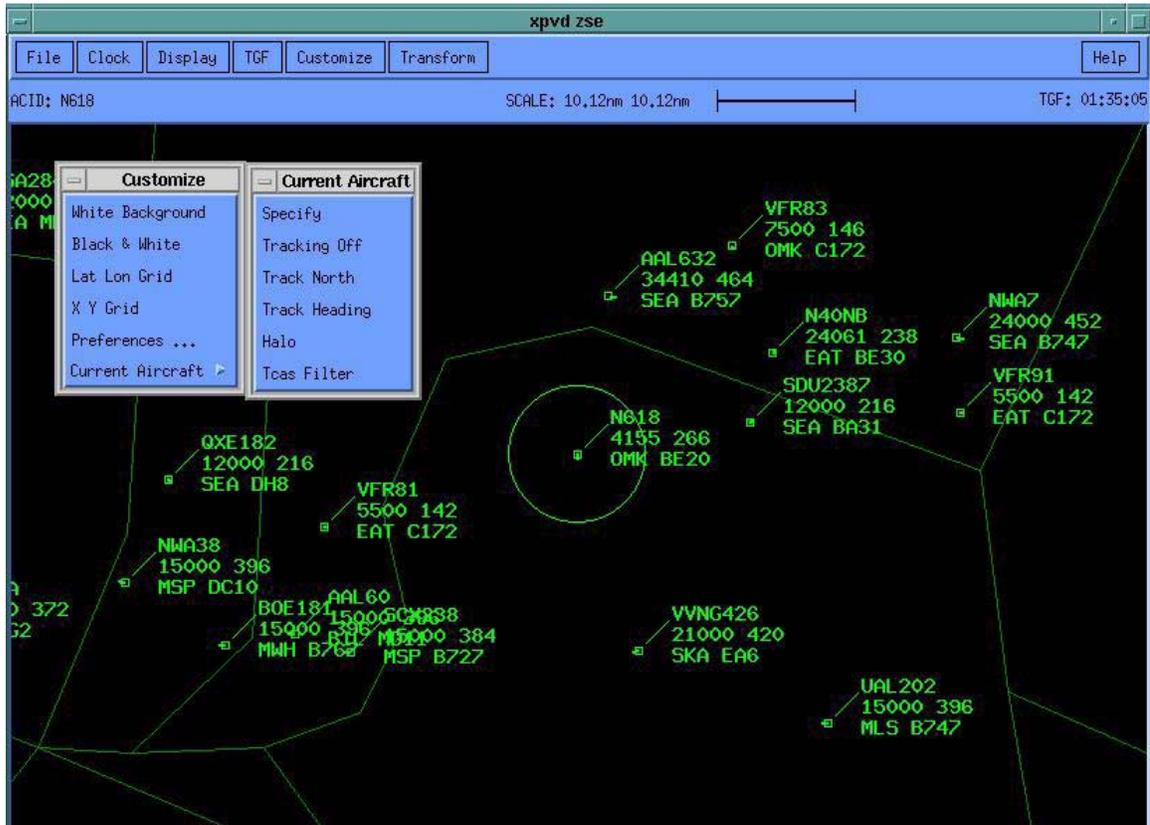
The Current Aircraft submenu of the Customize menu is shown below. The Current Aircraft submenu monitors the particular aircraft that the controller specifies. Shown below in Current Aircraft is specify and when this “SPECIFY” is clicked the sub submenu CURRENT ACID\_popup appears.

**Figure 3.3-37 Customize Current Aircraft is displayed**



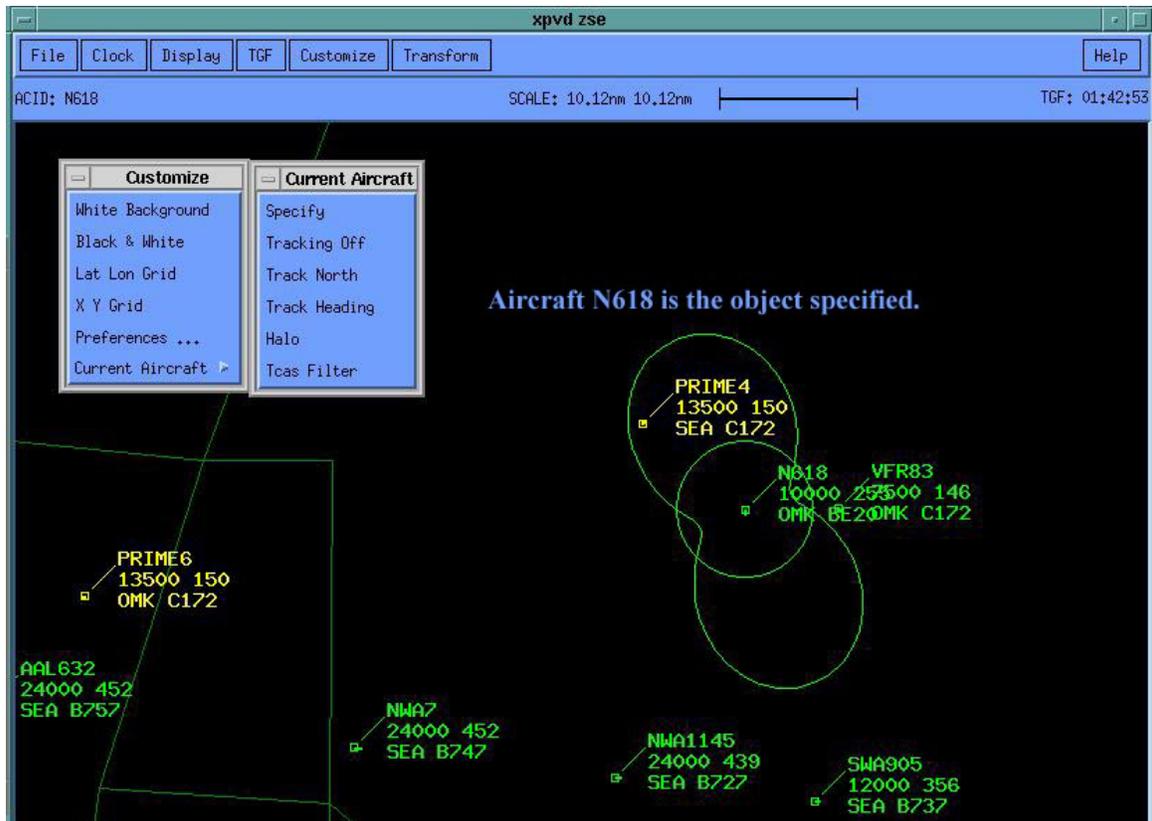
The diagram below depicts a Specified aircraft, N618, with Track North, Track Heading, and Halo all active. TCAS filter is not active.

**Figure 3.3-38 Customize Current Aircraft N618 – TCAS off**



The diagram below depicts a Specified aircraft, N618, with Track North, Track Heading, and Halo all active. The Terminal Collision Avoidance System (TCAS) filter is active. The TCAS filter is the figure eight looking boundary around aircraft N618. Notice aircraft PRIME at a safe higher altitude.

**Figure 3.3-39 Current Aircraft customized with TCAS Filter “ON”.**



### 3.3.6 Transform Menu

#### 3.3.6.1 Rotate and Scale

The Transform menu gives the controller the option to rotate and to scale the map accordingly. When you rotate the map counter clockwise use the 'minus' or 'hyphen' sign.

**Figure 3.3-40 Transform's - Rotate and Scale submenus**

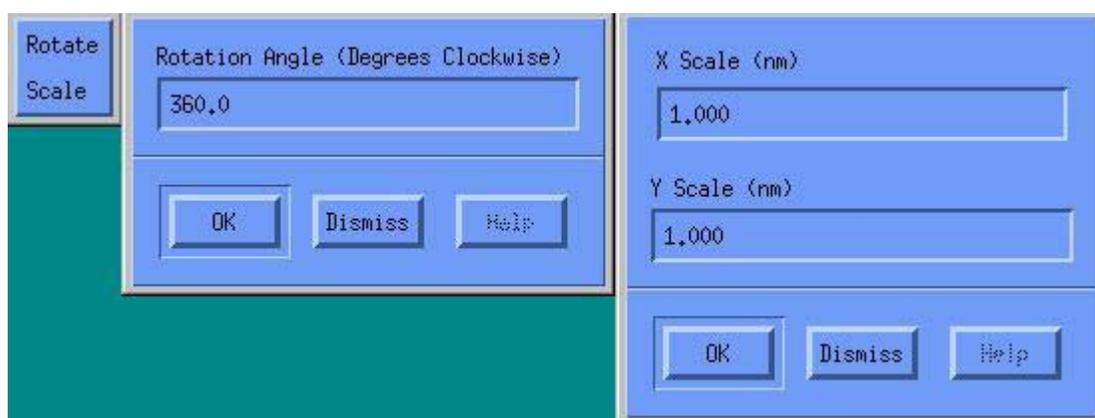
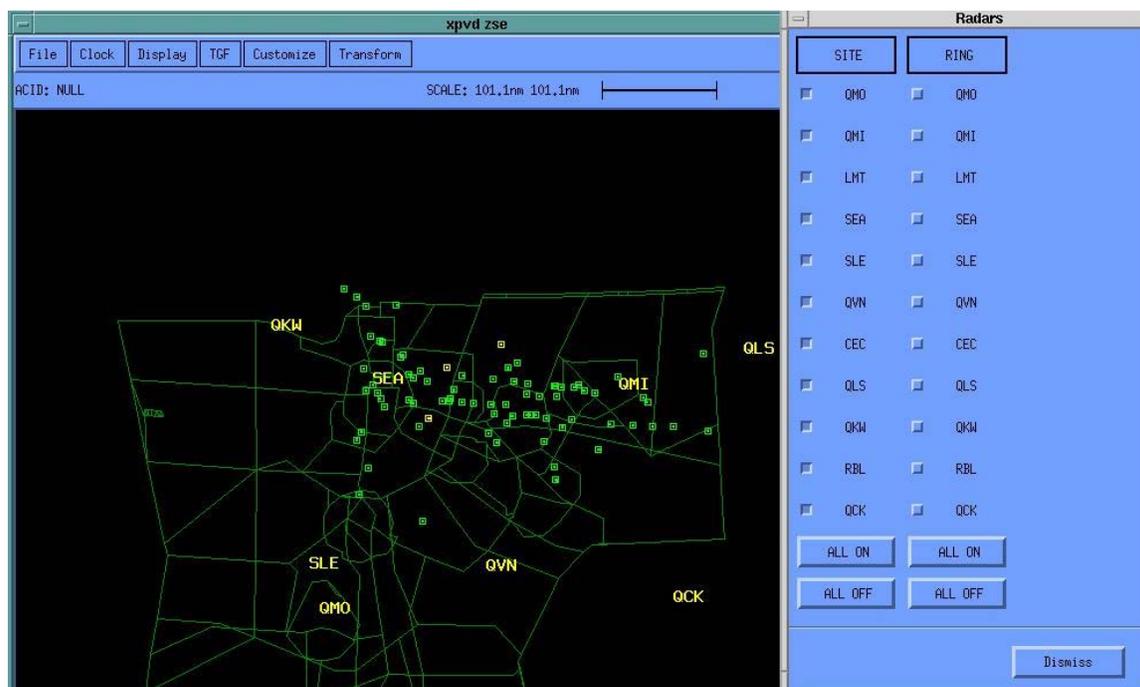




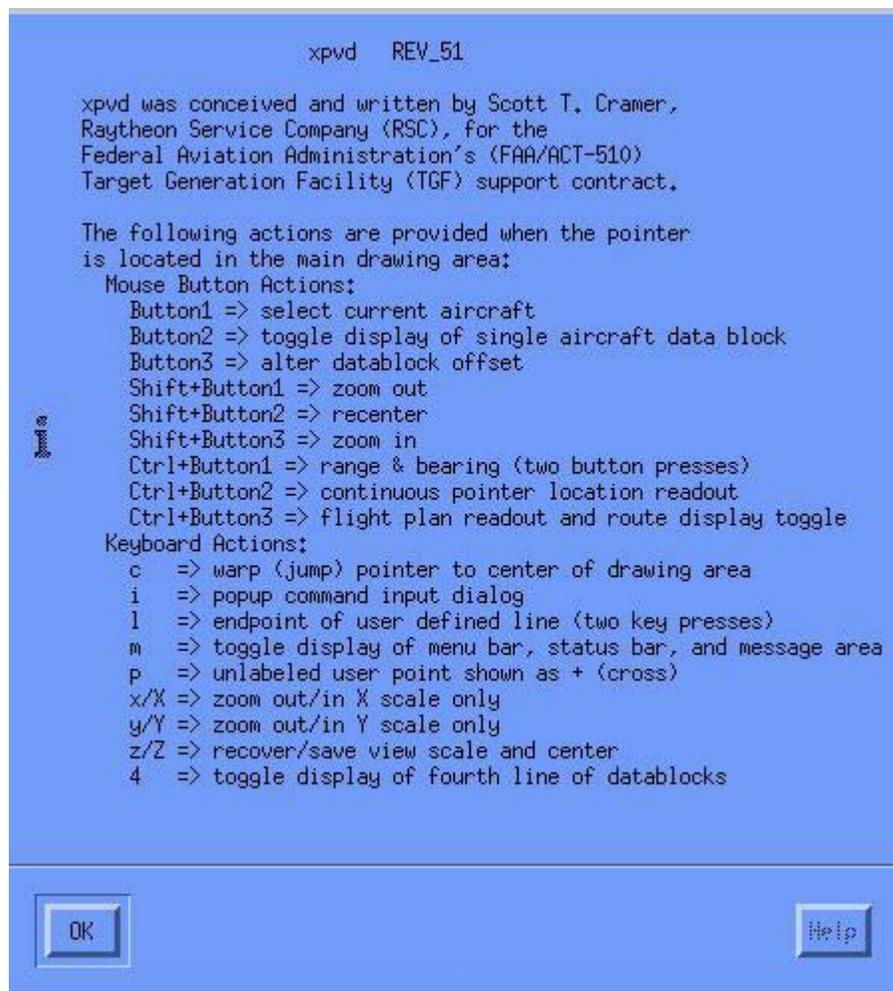
Figure 3.3-42 Rotated 0 degrees and Scaled at 101 Nautical miles



### 3.3.7 Help Menu

The last menu is the Help Menu. It gives the key combinations in order to manipulate the map when zooming in and out, centering, calculating distances, drawing lines, and turning the menus off and on to name a few of the multifaceted functions the XPVD tool can accomplish.

**Figure 3.3-43 Help Menu**



## **4 XPVD SDSERVER Programming Interface**

### **4.1 *Communication Protocol***

The SDSERVER receives flight information from TGF via directed UDP protocol. In turn, the SDSERVER will save pre-flight information in an internal table. When a XPVD is initially connected to sdsrver this flight information is transferred to XPVD via either UDP or TCP connections. The following sections depict the different communication protocols.

#### **4.1.1 UDP INTERFACE**

The XPVD that runs on the SPW's communicate via UDP with the SDSERVER. Figure 4.1-1 illustrates the UDP protocol.

#### **4.1.2 TCP INTERFACE**

All other XPVD workstations communicate with the SDSERVER via TCP. Figure 4.1-2 illustrates the TCP communication protocol.

#### **4.1.3 XPVD TO XPVD INTERFACE**

XPVD clients may on occasion need to speak to all other SPW XPVD clients. This is accomplished with the INTERCLIENT message. Figure 4.1-3 illustrates the INTERCLIENT data flow.

**Figure 4.1-1 XPVD – SDSERVER UDP PROTOCOL**

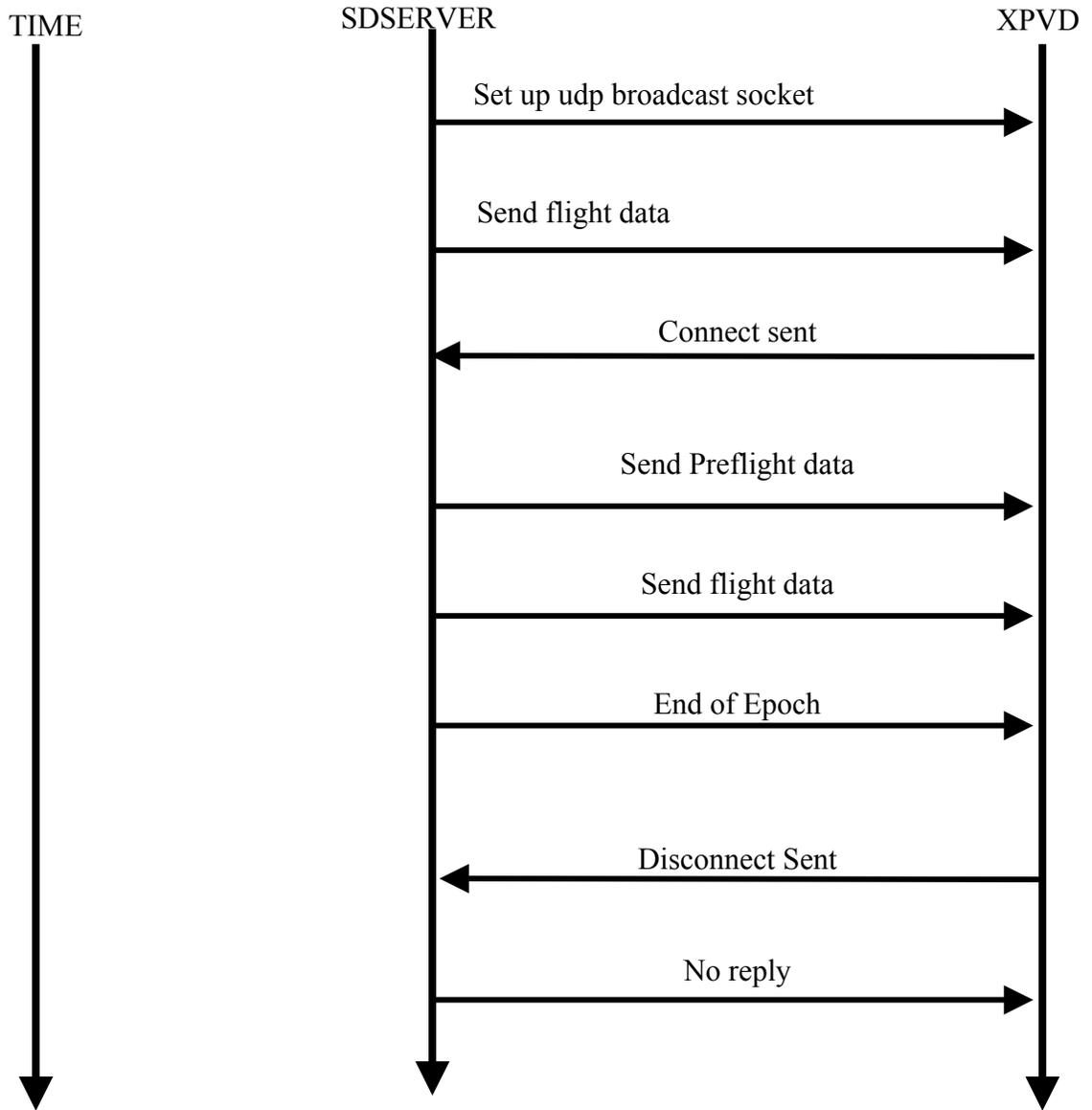
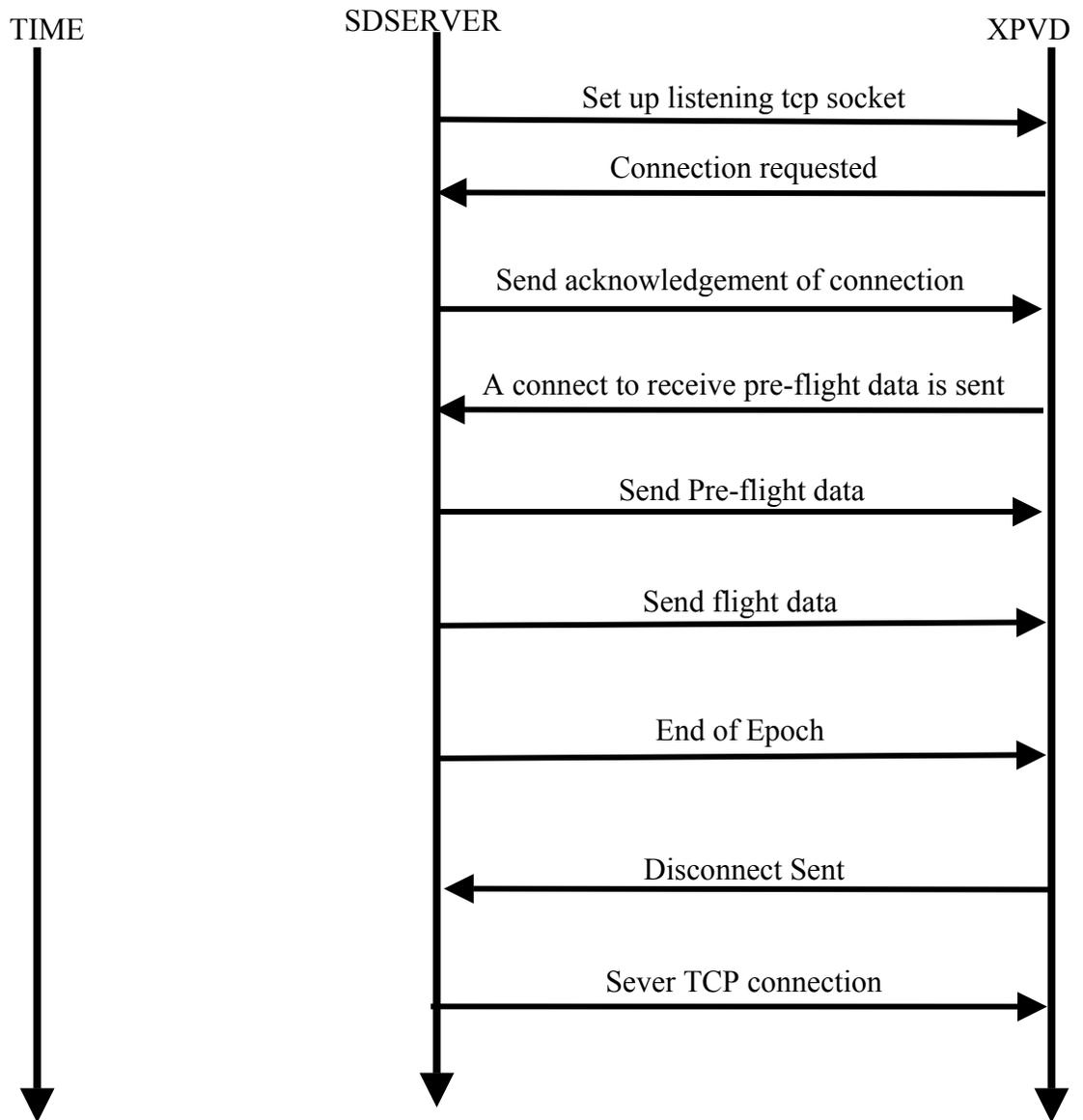
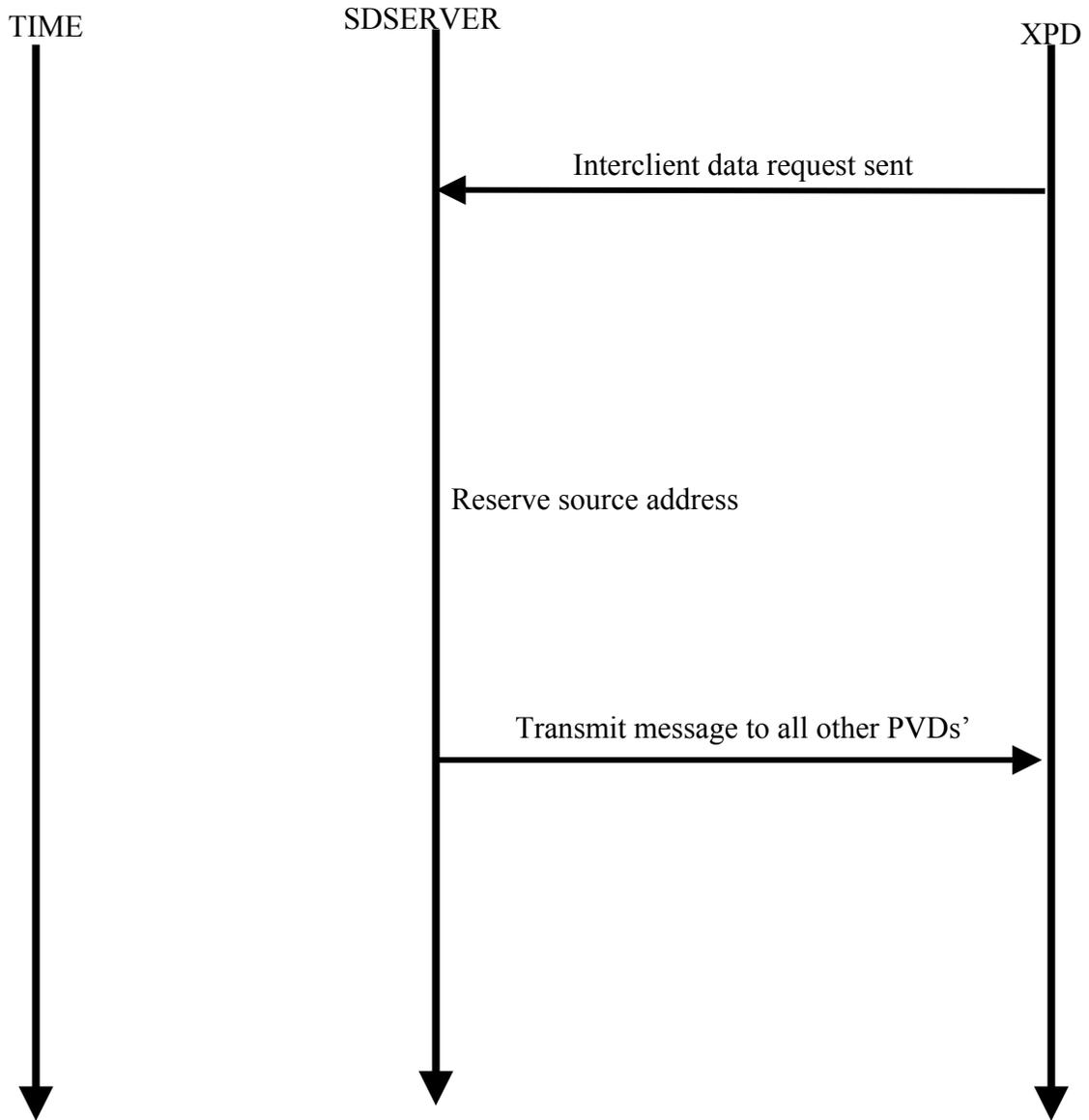


Figure 4.1-2 XPVD – SDSERVER TCP PROTOCOL



**Figure 4.1-3 XPVD – XPVD CLIENT INTERFACE**



## 4.2 Data

The following section describes the messages sent from SDSERVER to XPVD.

### 4.2.1 GENERAL INFORMATION

The following is a list of the messages that are sent from the SDSERVER to XPVD. Each one shall be discussed in this chapter.

**Table 4.2.1-1 List of Message Identifiers**

Message Identifier	Value	Description
SIM_INIT	302	TGF sends SDS at start of new sim
ACK	302	acknowledgement message
CONNECT	303	connection accepted *
END_DATA	306	end of flight data
SDS_HANGUP	308	SDS has disconnected or XPVD has disconnected
PREFLIGHT	310	pre-flight data
FLIGHT	311	flight data
TERM FLIGHT	312	terminate flight
INTERCLIENT	313	interclient data
WXLO	314	weather low messages
WXHI	315	High intensity weather messages
WXMD	316	Medium intensity weather messages
REQ_FPLAN	317	Request pre-flight messages

\* The CONNECT is an exception in the list. This message is from XPVD to SDSERVER. It is sent on an initial connection to the SDSERVER. This CONNECT informs the SDSERVER to download the pre-flight message database to XPVD. This assures that all active target information is visible on the XPVD screen.

The general format of the messages from SDSERVER to XPVD starts with one of the message identifiers as described above followed by the data for that message.

**Table 4.2.1-2 General Format of the data sent from SDSERVER to XPVD**

FIELD	LENGTH IN BYTES	FORMAT
Message Identifier	4	Enumeration
Data	Variable	Variable

#### 4.2.2 Request for Pre-Flight Messages

Whenever a new XPVD application starts, XPVD requests the pre-flight data from SDSERVER. The layout for the request for pre-flight messages is below.

**Table 4.2.2-1 Format for Request for Pre-flight Messages**

FIELD DESCRIPTION	INTERNAL DATA NAME <sup>1</sup>	LENGTH IN BYTES	FORMAT	VALUE
Message Identifier	Msgn	4	Enumeration	317
Flight Identifier	Flight_id	8	ASCII	
Spare	Spare	4	character	

##### 4.2.2.1 Message Identifier

The message identifier for a request for preflight message is the value “REQ\_FPLAN”. The numeric value for this is “317”. One of these messages exist per starting XPVD.

##### 4.2.2.2 Flight Identifier

<sup>1</sup> The actual data names found in the source code for CTG, TG, SDSERVER, and XPVD are all in lower case.

### 4.2.3 TGF PRE-FLIGHT MESSAGES

A short synopsis from the “TGF Universal Flight Plan ICD” was used for the field definitions found in this ICD. For a more thorough discussion or understanding of the fields mentioned here, one should click this [“TGF Universal Flight Plan ICD”](#).

**Table 4.2.3-1 Format of Pre-flight Message**

FIELD DESCRIPTION	INTERNAL DATA NAME <sup>2</sup>	LENGTH IN BYTES	FORMAT	VALUE
Message Identifier	Msgn	4	Enumeration	310
Departure Time	Departure_time	4	Integer	
Aircraft Identifier	Flight_id	8	ASCII String	Alphanumeric
Aircraft Type	Ac_type	12	ASCII String	
Destination Fix	Dest_fix	28	ASCII String	
Route	Route	128	ASCII String	
Assigned Altitude	Assigned_altitude	4	Floating point	
Filed speed	Filed_speed	4	Floating point	
Frequency	Freq	4	Binary	
Beacon code	Beacon	2	Binary	
Spare	Spare	2	ASCII String	
Runway Name	Runway	8	ASCII String	

#### 4.2.3.1 Message Identifier

The message identifier for a preflight message is the value “PREFLIGHT”.

The numeric value for this is “310”. One of these messages exist per starting aircraft in a simulation

#### 4.2.3.2 Departure Time

This is the departure time that is relative to the commencement of the simulation.

If the user enters a start time of 0 this flight will await a manual start.

#### 4.2.3.3 Aircraft Identifier

This field contains the aircraft identification (ID). This ID is used as the name of the flight both in discussion and in data reduction and analysis.

The ID starts with a letter and is followed by one to six alpha-numerics.

---

<sup>2</sup> The actual data names found in the source code for CTG, TG, SDSERVER, and XPVD are all in lower case.

#### **4.2.3.4 Aircraft Type**

This field is up to 12 bytes long and represents the type of aircraft and the airborne equipment qualifier. It may also include a number of flights indicating that more than one aircraft will be sharing this flight plan. This field also includes a weight class indicator.

This field is used to determine aircraft performance and navigational characteristics.

#### **4.2.3.5 Destination Fix**

This field contains the destination fix which could be either a point where the aircraft is handed off to another sector, or control is transferred, or represents the destination airport fix.

#### **4.2.3.6 Route**

This field contains the TGF route of flight. This is a list of navigational fixes and airways that make up the route the aircraft will travel. The aircraft will start at the initial fix and continue following each step of the flight plan until it terminates or lands at the final fix.

The route may contain reference to a published route as one that is found in a FAA document or a simulation route as derived for this simulation by the customer and TGF staff.

#### **4.2.3.7 Assigned Altitude**

This field represents the altitude to which the aircraft will climb or descend, if it is different from the TGF starting altitude.

#### **4.2.3.8 Filed Speed**

This field is the highest speed TGF will fly the aircraft. This is the cruising speed of a filed flight plan. In addition, this is the airspeed that is normally filed in a NAS flight plan.

#### **4.2.3.9 Frequency**

This field contains the air-to-ground VHF frequency for the initial (controlling) sector.

The flight will begin the simulation in the sector controlled by this frequency. This frequency is also used to assign the flight to a simulation pilot.

#### **4.2.3.10 Beacon Code**

This field contains the beacon code assigned to the aircraft.

#### **4.2.3.11 Spare**

This field is used for padding. It is 2 bytes in length and is required for alignment.

#### **4.2.3.12 Runway Name**

This field contains the aircraft's departure runway. This field may also contain a heading to be flown from the runway. A departure runway is required for Standard Instrument Departures (SIDS). If a departure runway is not specified, the aircraft will fly from the airport directly to the first fix on its route. This heading field can hold a heading to be flown from the starting point in an ARTS simulation.

## 4.2.4 FLIGHT MESSAGES

**Table 4.2.4-1 Format of Flight Message**

FIELD DESCRIPTION	INTERNAL DATA NAME	LENGTH IN BYTES	FORMAT	VALUE
Message Identifier	Msgn	4	Enumeration	311
Time	Time	4	Integer	
Aircraft Identifier	Flight_id	8	ASCII String	
Longitude	Lon_degs	4	Floating point	
Latitude	Lat_degs	4	Floating point	
Ground Speed	Ground_spd_mph	4	Floating point	
Heading	Hdg_degs	4	Floating point	
Altitude	Alt	4	Floating point	
Climb Rate	Climb_rate_ftsec	4	Floating point	
Frequency	Freq	4	Binary	
Beacon Code	Beacon	2	Binary	
Ident Control	Ident	1	Flag	
Highlight a/c	Highlight	1	Flag	

### 4.2.4.1 Message Identifier

The message identifier for a flight message is the value “FLIGHT”. The numeric value for this is “311”.

### 4.2.4.2 Time

This field represents the simulation time in seconds. It is not the time relative to the beginning of the sim nor does it represent the real world time.

### 4.2.4.3 Aircraft Identification

This field contains the aircraft ID. This ID is used as the name of the flight both in discussion and in data reduction and analysis.

The ID starts with a letter and is followed by one to six alpha-numeric characters.

### 4.2.4.4 Longitude

This is the current longitude that the aircraft is flying.

#### **4.2.4.5 Latitude**

This is the current latitude that the aircraft is flying.

#### **4.2.4.6 Ground Speed**

This is the airspeed in terms of the ground as a reference point.

#### **4.2.4.7 Heading**

This is the current direction the aircraft is flying.

#### **4.2.4.8 Altitude**

This is the current altitude of the aircraft.

#### **4.2.4.9 Climb Rate**

This field describes how fast an aircraft is climbing/descending in feet.

#### **4.2.4.10 Frequency**

This field contains the air-to-ground VHF frequency for the initial (controlling) sector.

The flight will begin the simulation in the sector controlled by this frequency. This frequency is also used to assign the flight to a simulation pilot.

#### **4.2.4.11 Beacon Code**

This field contains the beacon code assigned to the aircraft.

#### **4.2.4.12 Ident**

Some transponders are equipped with an Ident button. During a Simulation the controller may request a pilot to hit the ident, as a result a special symbol shall appear at the controller's workstation.

#### **4.2.4.13 Highlight**

This is a byte flag field. This field is used to indicate which aircraft is from the cockpit simulator workroom.

## 4.2.5 TERMINATE FLIGHT MESSAGE

This message is issued when an aircraft is to end its simulation flight. As a result of this command, the aircraft will disappear from the XPVD screen.

**Table 4.2.5-1 Format of Terminate Flight Message**

FIELD DESCRIPTION	INTERNAL DATA NAME	LENGTH IN BYTES	FORMAT	VALUE
Message Identifier	Msgn	4	Enumeration	300-316
Aircraft Identification	Flight_id	8	ASCII String	
Spare	Spare	4	N/A	

### 4.2.5.1 Message Identifier

The message identifier for a terminate flight message is the value “TERM\_FLIGHT”. The numeric value for this is “312”.

### 4.2.5.2 Aircraft Identification

This field contains the aircraft ID. This ID is used as the name of the flight both in discussion and in data reduction and analysis.

### 4.2.5.3 Spare

This field is used for padding. It is 4 bytes in length and is required for alignment.

## 4.2.6 WEATHER LOW INTENSITY MESSAGES

Weather data comes off the radar sites in rho theta format. It is received off the BYTEX in digitized format. Low intensity weather is used in detecting the start of precipitation.

**Table 4.2.6-1 Format of the data for Weather Low Intensity**

FIELD DESCRIPTION	INTERNAL DATA NAME	LENGTH IN BYTES	FORMAT	VALUE
Message Identifier	Msgn	4	Enumeration	300-316
Time	Time	4	Binary	
Site Identifier	Site_id	12	ASCII String	
Azimuth	Azimuth	4	Binary	
Start of Range	Range_start	4	Floating point	
Range Stop	Range_stop	4	Floating point	

### 4.2.6.1 Message Identifier

The message identifier for a weather low intensity message is the value “WXLO”. The numeric value for this is “314”.

### 4.2.6.2 Time

This field represents the simulation time in seconds. It is not the time relative to the beginning of the sim nor does it represent the real world time. It is the sim time that the weather message is received.

### 4.2.6.3 Site Identifier

This field identifies the radar sites receiving radar data for the simulation. Each radar site has up to 3 characters. An instance of weather may therefore be received by up to 4 radar sites. The radar site is the reference point for the azimuth and range data.

### 4.2.6.4 Azimuth

This field represents the theta or angle from the radar site to the piece of weather data.

#### 4.2.6.5 Start of Range

This field is derived from the rho of the rho theta weather format received off the BYTEX. In particular, the start of range refers to the defined distance from the named radar sites to the particular weather phenomena, namely the beginning of the precipitation.

#### 4.2.6.6 Range Stop

This field is derived from the rho of the rho theta weather format received off the BYTEX. In particular, the end of range refers to the defined distance from the named radar sites to the end of a particular weather phenomena, namely the end of the precipitation.

### 4.2.7 WEATHER HIGH INTENSITY MESSAGES

High intensity weather refers to rain and heavier rain.

**Table 4.2.7-1 Format of the Weather High Data Packet**

FIELD DESCRIPTION	INTERNAL DATA NAME	LENGTH IN BYTES	FORMAT	VALUE
Message Identifier	Msgn	4	Enumeration	300-316
Time	Time	4	Binary	
Site Identifier	Site_id	12	ASCII String	
Azimuth	Azimuth	4	Binary	
Range	Range	4	Floating point	

#### 4.2.7.1 Message Identifier

long msgn

The message identifier for a high intensity weather message is the value “WXHI”. The numeric value for this is “315”.

#### 4.2.7.2 Time

This field represents the simulation time in seconds. It is not the time relative to the beginning of the sim nor does it represent the real world time. It is the sim time that the weather message is received.

#### **4.2.7.3 Site Identifier**

This field identifies the radar sites receiving radar data for the simulation. Each radar site has up to 3 characters. An instance of weather may therefore be received by up to 4 radar sites. The location of the radar site is the reference point for the azimuth and range data.

#### **4.2.7.4 Azimuth**

This field represents the theta or angle from the radar site to the piece of weather data.

#### **4.2.7.5 Range**

This field is derived from the rho of the rho theta weather format received off the BYTEX. The high intensity weather is worse than low intensity weather, it implies precipitation is present. For this reason, there is no range start and no range stop for high intensity weather. The radar can't detect the start or stop of this particular weather. So the range for high intensity weather refers to the defined distance from the named radar site to the particular weather storm.

## 4.2.8 WEATHER MEDIUM INTENSITY MESSAGES

Medium intensity weather refers to rain and heavier rain.

**Table 4.2.8-1 Format of the Weather High Data Packet**

FIELD DESCRIPTION	INTERNAL DATA NAME	LENGTH IN BYTES	FORMAT	VALUE
Message Identifier	Msgn	4	Enumeration	316
Time	Time	4	Binary	
Site Identifier	Site_id	12	ASCII String	
Azimuth	Azimuth	4	Binary	
Range	Range	4	Floating point	

### 4.2.8.1 Message Identifier

The message identifier for a medium intensity weather message is the value “WXMD”. The numeric value for this is “316”.

### 4.2.8.2 Time

This field represents the simulation time in seconds. It is not the time relative to the beginning of the sim nor does it represent the real world time.

### 4.2.8.3 Site Identifier

This field identifies the radar sites receiving radar data for the simulation. Each radar site has up to 3 characters. An instance of weather may therefore be received by up to 4 radar sites. The radar site is the reference point for the azimuth and range data.

### 4.2.8.4 Azimuth

This field represents the theta or angle from the radar site to the piece of weather data.

#### 4.2.8.5 Range

This field is derived from the roe of the roe theta weather format received off the BYTEX. The medium intensity weather is worse than low intensity weather, it implies precipitation is present. For this reason, there is no range start and no range stop for medium intensity weather. The radar can't detect the start or stop of this particular weather. So the range for medium intensity weather refers to the defined distance from the named radar site to the particular weather storm.

#### 4.2.9 INTERCLIENT MESSAGES

This message is sent from XPVD to the SDSERVER. In turn SDSERVER will take this message and broadcast the message to all XPVD clients. The table below outlines the contents of an interclient message.

**Table 4.2.9-1 Format of Interclient Message**

FIELD DESCRIPTION	INTERNAL DATA NAME	LENGTH IN BYTES	FORMAT	VALUE
Message Identifier	Msgn	4	Enumeration	300-316
Aircraft Identification	Flight_id	8	ASCII String	
Source Address	Src_addr	4	I/P address	
Spare	Spare	16	N/A	

##### 4.2.9.1 Message Identifier

The message identifier for an interclient message is the value "INTERCLIENT". The numeric value for this is "313".

##### 4.2.9.2 Aircraft Identification

This field contains the aircraft ID. This ID is used as the name of the flight both in discussion and in data reduction and analysis.

The aircraft ID is 7 alphanumeric bytes long, with the first character an alphabetic.

### 4.2.9.3 Source Address

This field identifies the XPVD workstation that has a message to convey to all other XPVD clients.

### 4.2.9.4 Spare

This field is used for padding. It is 16 bytes in length and is reserved for future use.

## 4.2.10 Communication Status data packets

The following messages just consist of the message identifier only:

- SIM\_INIT – TGF sends SDSERVER at the start of a new sim
- ACK – acknowledgement of connection
- CONNECT – data connection and data wanted
- END\_DATA – end of flight data epoch has been reached
- SDS\_HANGUP – SDS has terminated
- TGF\_HANGUP – TGF has terminated

There is no data for these messages.

The format for these messages is shown in below.

**Table 4.2.10-1 Format of SDS\_INIT, ACK, CONNECT, END\_DATA, HANGUPS**

FIELD	LENGTH IN BYTES	FORMAT
Message Identifier	4	Enumeration

## **5 XPVD Exercise Control Workstation Interface**

Initial booting of the Simulation Pilot (SimPilot) Workstations (SPW) takes place at the beginning of a simulation (sim). The simulation lead clicks on the wanted SimPilot workstation ICONS via a GUI Interface at the ECW (Exercise Control Workstation). The ECW is also referred to as the ECO. The ECO software is responsible for configuring the requested SPWs at this time. The GUI interface is depicted in the figure below.

During this boot the XPVD software is started at these SPWs. The target data generated at these XPVDs at the SPW is via a UDP broadcast from the SDSERVER.

## Appendix A: Commands

### 1.1 AIRWAY Command

The AIRWAY command is used to define the airways composed of the fixes in the database. These airways are published and are taken from the ACES data.

#### 1.1.1 AIRWAY Command Syntax:

```
AIRWAY  name      fix1      fix2      ...      fixn  name
      fix1 fix2
```

#### 1.1.2 Examples:

```
AIRWAY  V112  HQM  ILWAC  ...  YXC188037  YXC
AIRWAY   J14  GSO  99514  ...  COLIN      PXT
```

#### 1.1.3 ARGUMENTS:

AIRWAY: String denoting the name of airway.

*fix1, fix2, ..fixn*: The name of the fixes and FRD's that make up the airway.

#### 1.1.4 ARGUMENT Format:

*name*: a string of non-blank characters denoting the name of the airway.

*fixn*: a string of non-blank characters denoting the name of the :  
*fix*.

keyword: fixn...

## 1.2 CENTER Command

The CENTER command defines the center of the viewed area.

### 1.2.1 CENTER Command Syntax:

CENTER *LL* *Latitude* *Longitude*

CENTER *XY* *x* *y*

### 1.2.2 Example:

CENTER LL 391024 764018

CENTER XY -0.241 -0.583

### 1.2.3 Arguments:

*Latitude*: Defines the latitude to be positioned at the center of the viewed area.

*Longitude*: Defines the longitude to be positioned at the center of the viewed area.

*x-coordinate*: x - coordinate to be positioned at the center of the viewed area.

*y-coordinate*: y - coordinate to be positioned at the center of the viewed area.

### 1.2.4 Argument Format:

*Latitude*: [h]hhmmss [.xxx]

*Longitude*: [h]hhmmss [.xxx]

*x*: n [.n]

*y*: n [.n]

### 1.3 DISPLAY Command

The DISPLAY command renders the location of the object on the screen.

#### 1.3.1 DISPLAY Command Syntax

```
DISPLAY object name
```

#### 1.3.2 Example

```
DISPLAY FIX Belay
```

```
DISPLAY AIRWAY J123
```

#### 1.3.3 Arguments:

*object*: a string of characters denoting the type of object.

*name*: a string of characters denoting the name of the object.

#### 1.3.4 Argument Format:

*object*: string

*name*: *keywords: FIX, AIRWAY, ROUTE*

## 1.4 FIX Command

The FIX command defines the fix's coordinates in the XPVD database in either latitude/longitude or xy-coordinates.

### 1.4.1 FIX Command Syntax:

```
FIX name LL Latitude Longitude magnetic_declination
FIX name XY x-coord y-coord magnetic_declination
```

### 1.4.2 Example:

```
FIX Belay LL 393515 761801 12
FIX Belay XY 16.987 24.276 15
```

### 1.4.3 Arguments:

*Name:* a string of non-blank characters denoting the name of the fix.

*Latitude:* Defines the latitude of the fix's location.

*Longitude:* Defines the longitude of the fix's location.

*x-coord:* x - coordinate of the fix's location.

*y-coord:* y - coordinate of the fix's location.

### 1.4.4 Argument Format

*Name:* String

*Latitude:* [h]hhmmss[.xxx]

*Longitude:* [h]hhmmss[.xxx]

*x-coord:* n[.nn]

*y-coord:* n[.nn]

## 1.5 NODE Command

The NODE command enables the placement of points of intersections of sector boundaries.

### 1.5.1 NODE Command Syntax

<b>NODE</b>	<i>name</i>	<b>LL</b>	<i>latitude</i>	<i>longitude</i>
-------------	-------------	-----------	-----------------	------------------

### 1.5.2 Example:

NODE	X222	LL	462030	1255750
NODE	X223	LL	454856	1265200

### 1.5.3 Arguments:

*name:* A string of non-blank characters denoting the name of the Node.

*latitude:* Defines the latitude of the Node's location.

*longitude:* Defines the longitude of the Node's location.

### 1.5.4 Argument Format:

*name:* A string of non-blank characters denoting the name of the Node.

*latitude:* [h]hhmmss [.xxx]

*longitude:* [h]hhmmss [.xxx]

## 1.6 ROUTE Command

The ROUTE command defines the actual route the aircraft will take. It consists of fixes that have been defined in the database or given through the **pop-up** command interface.

### 1.6.1 ROUTE Command Syntax

```
ROUTE          name          fix1          fix2...
```

### 1.6.2 Example:

```
ROUTE      BOE620   MWH  GEG  MWH
```

### 1.6.3 Arguments:

*name*: String denoting the name of route.

*fix1 ...*: The name of the fixes and FRD's that make up the route.

### 1.6.4 Argument Format:

*name*: a string of non-blank characters denoting the name of the route.

*fix1 ...*: keyword: *fix1...*

## 1.7 RSITE Command

The RSITE command is for radar site placement consisting of their XY coordinates.

### 1.7.1 RSITE Command Syntax

```
RSITE    name      XY  x-coord  y-coord      range
(nm)
```

### 1.7.2 Example:

```
RSITE    QMO        XY  282.1250  326.6250      200.0
RSITE    QMI        XY  544.2500  522.5000      200.0
```

### 1.7.3 Arguments:

*name:* A string of non-blank characters denoting the name of the radar site.

*x-coord:* x-coordinate of the radar site's location.

*y-coord:* y- coordinate of the radar site's location.

*range:* The range of the radar site in nautical miles.

### 1.7.4 Argument Format:

*name:* A string of non-blank characters denoting the name of the radar site.

*x-coord:* n[ .nnn ]

*y-coord:* n[ .nnn ]

*range:* n[ .nnn ]

## 1.8 RUNWAY Command

The RUNWAY command is used to define values for airport runways and related characteristics. The command consists of four different formats, each defining separate aspects of the named runway. The particular format to be used is based on the third word in the command line, which can be: RUNWAY, LOCAL, SLOPE, or ZONE. Each one of these commands are required, they must be entered in the specified order. The RUNWAY/RUNWAY command defines the runway end points and its width. The RUNWAY/LOCAL command describes the runway centerline extension. The RUNWAY/SLOPE command describes the glideslope features such as outer marker and intercept fix. The RUNWAY/ZONE command defines the boundaries of the NTZ (no transgression zone) which appears between runways.

### 1.8.1 RUNWAY Command Syntax:

```
RUNWAY name RUNWAY      lat1      lon1      lat2
      lon2      width

RUNWAY name LOCAL angle      longend      direct      mapt

RUNWAY name SLOPE      gs      om      fix

RUNWAY name ZONE      tag      inner_end      divider_end
      outer_end
```

### 1.8.2 Examples:

```
RUNWAY 18R RUNWAY      37373048.953  881524.921  372910.604
881524.912  150.0
```

RUNWAY 10	ZONE	<i>tag</i>	0.500	12.000	
				12.500	
RUNWAY 18R	LOCAL	0.000	25.0	1.0	
				0.612368	
RUNWAY 18R	SLOPE	3.0	4.983737		
				12.388686	
RUNWAY 18R	ZONE	18C	0.500	15.690	15.7

### 1.8.3 Arguments:

*Name:* Defines the name of the runway (eg, 18L) and is up to 5 non-blank characters.

**RUNWAY:** Keyword to be followed by the latitude and longitude of the runway.

**LOCAL:** Defines localizer and extended centerline.

*name:* Defines the name of the runway (eg, 18L)

*Angle:* is degrees for centerline offset.

*Longend:* is nautical mile length of plotted extended centerline.

*Direct:* is -1, 0 or 1 to specify direction of reference lines of the NTZ: +1=up or left, -1=down or right, 0=both.

*Mapt:* is distance from threshold to MAP (missed approach point) in nautical miles and affects where the 'kink' occurs in an offset approach.

**SLOPE:** gs degrees (glideslope).

*Fix:* The distance in nautical miles from threshold to stepdown fix (ie, glideslope intercept)

*outer\_end:* Number of nautical miles from the reciprocal end of the runway to the end of the NTZ.

*inner\_end:* Number of nautical miles from reciprocal end of the runway to the reciprocal end of the NTZ.

*divider\_end:* Number of nautical miles from the reciprocal end of the NTZ to the divider (red vs yellow).

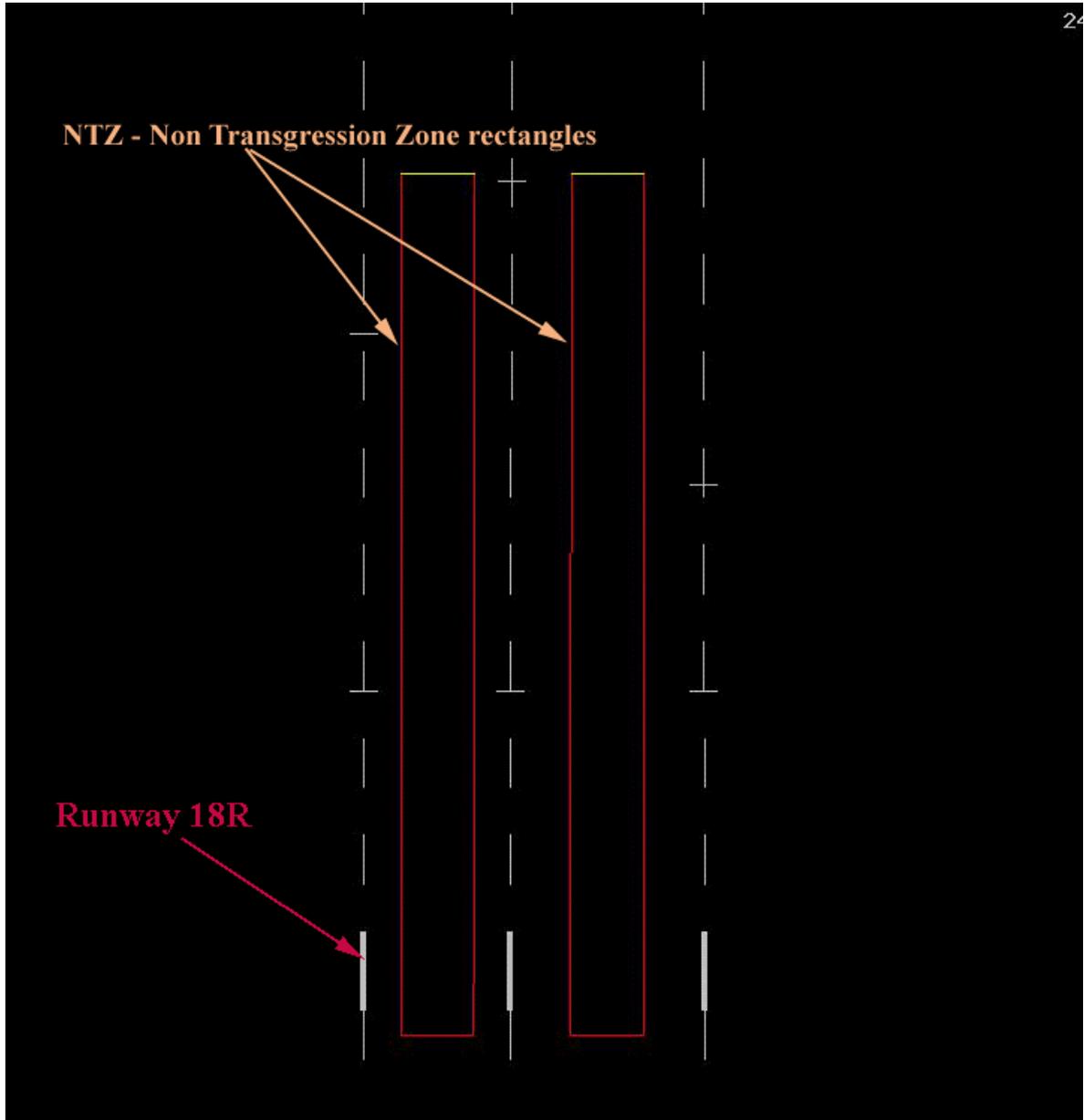
*Latitude:* Defines the latitude at the point of tangency of the stereographic projection.

*Longitude:* Defines the longitude at the point of tangency of the stereographic projection.

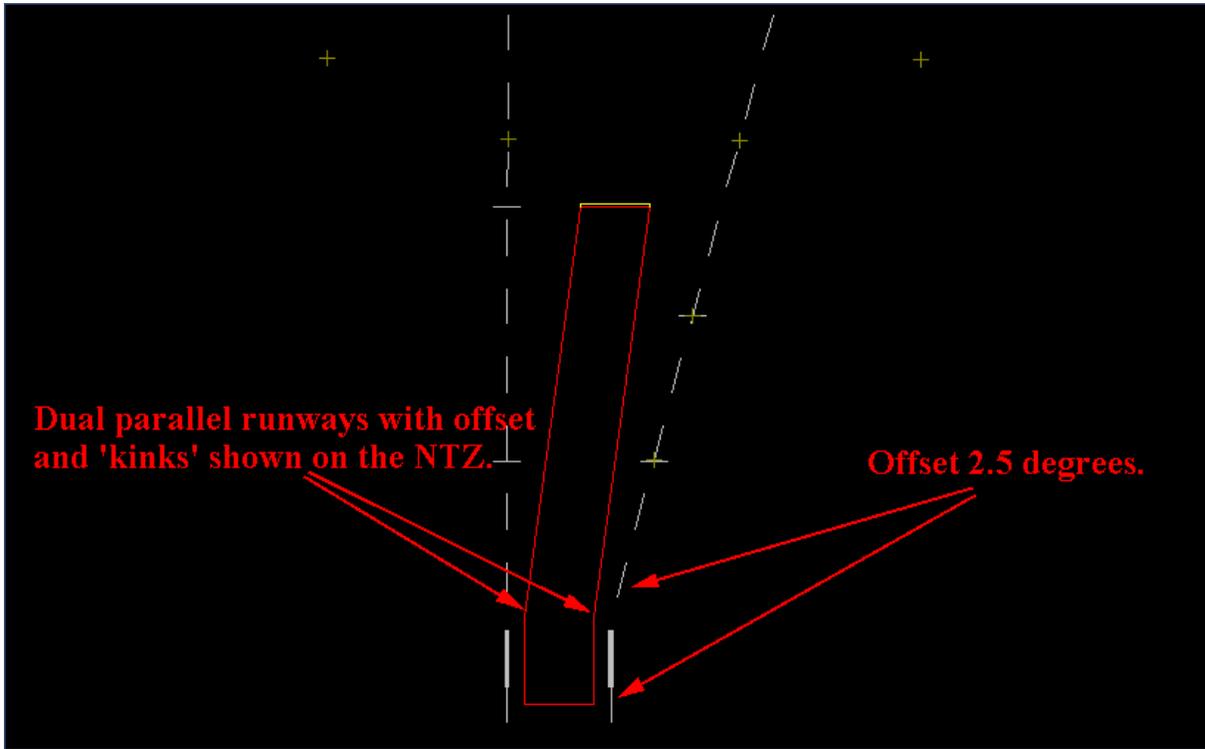
*Width:* The width of the runway in feet.

*Tag:* The second runway in the NTZ pair previously defined by RUNWAY/RUNWAY commad.

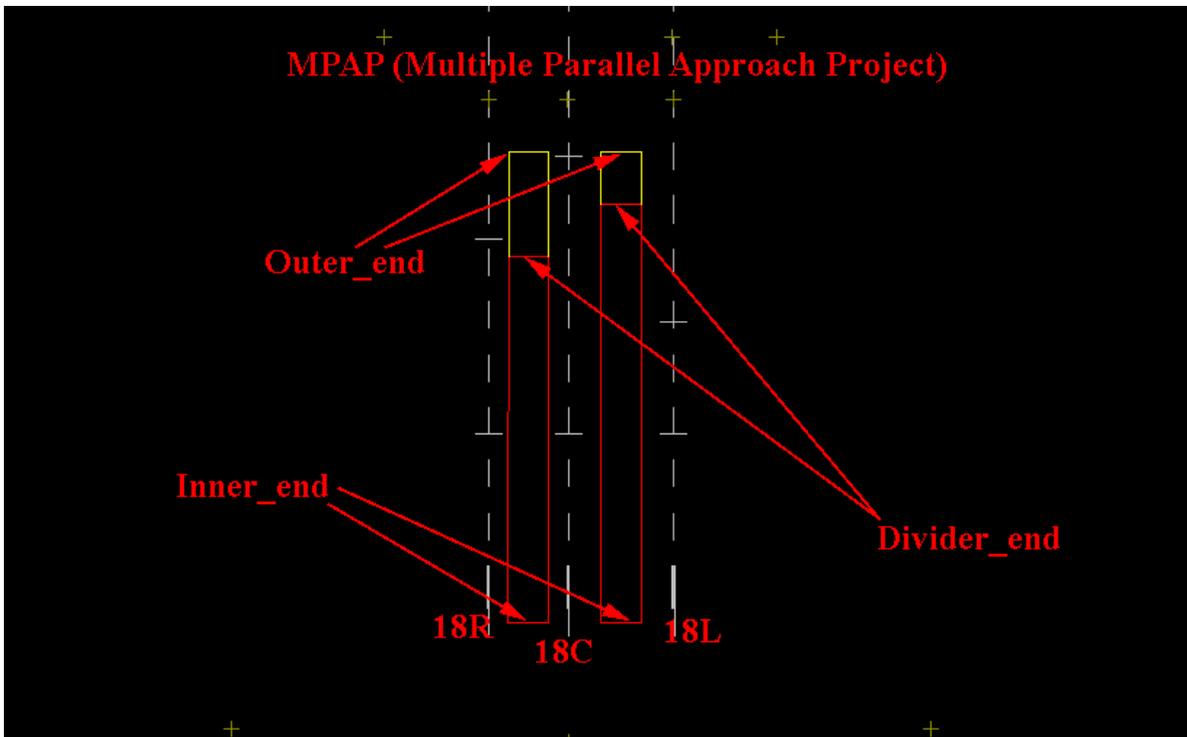
Below are figures that simplify a few of the terms used above:



5.1.1 Figure 1.6.1 Image depicting runway 18R and the no transgression zones.



5.1.2 Figure 1.6.2 Image showing dual runways with 'kink' in the offset localizer.



5.1.3 Figure 1.6.3 NTZ's with 'ends' shown for the MPAP map.

#### 1.8.4 Argument Format:

*Latitude:* [h]hhmmss[.xxx]

*Longitude:* [h]hhmmss[.xxx]

*X-coord:* n[nn...]

*Y-coord:* n[nn...]

*Width:* n[nn...]

*Tag:* String

*Mapt:* nn[n.nn]

*divider\_end:* nn[n.nn]

*inner\_end:* nn[n.nn]

*Fix:* nn[n.nn]

*Om:* nn[n.nn]

*Runway:* String

*Slope:* n[.nn]

## 1.9 SCALE Command

The SCALE command defines the conversion factor per units of nautical miles on the XPVD screen.

### 1.9.1 SCALE Command Syntax:

```
SCALE    X    Y
```

### 1.9.2 Example:

```
SCALE    1.0  1.0
```

### 1.9.3 Arguments:

*X*: a number denoting the scale along the x-axis in nautical miles.

*Y*: a number denoting the scale along the y-axis in nautical miles.

### 1.9.4 Argument Format:

*X*: n[.n]

*Y*: n[.n]

## 1.10 STEREOG Command

The STEREOG command defines the stereographic projection used by the XPVD to convert measurements in Latitudes and Longitudes to XY coordinates and vice versa.

### 1.10.1 STEREOG Command Syntax

```
STEREOG Latitude Longitude Radius x-coord y-coord
```

### 1.10.2 Example:

```
STEREOG 391107 0764055 0 -0.721 0.123
STEREOG 390950 0763944 0 0.203 -1.152
```

### 1.10.3 Arguments:

*Latitude*: Defines the latitude at the point of tangency of the stereographic projection.

*Longitude*: Defines the longitude at the point of tangency of the stereographic projection.

*Radius*: Conformal earth radius at point of tangency. A zero in this position will have XPVD calculate the value automatically.

*x-coord*: x - coordinate in nautical miles at point of tangency.

*y-coord*: y - coordinate at nautical miles point of tangency.

### 1.10.4 Argument Format:

*Latitude*: [h]hhmmss [.xxx]

*Longitude*: [h]hhmmss [.xxx]

*Radius*: n

*x-coord*: n

*y-coord*: n