Northern Lights Software Associates

Nova for Windows
User's Manual

by

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Introduction

Nova for Windows is an innovative map-based satellite tracking system. It features over 150 realistic 256-color and 16-bit color maps, unlimited numbers of satellites, observers, and views, as well as real-time control of antennas through several popular hardware interfaces.

Northern Lights Software Associates

- Sound alarms for AOS & LOS
- Built-in FTP for download of Keplerian elements
- 1,600 stars and constellations included

In this manual, "Nova" and "NfW" refer to *Nova for Windows*.

Features:

- Visually stunning maps, multiple sizes
- Unlimited numbers of satellites, observers, and views simultaneously
- Tracks all artificial satellites, Moon, Sun, planets, and celestial noise sources
- Fast, accurate, clear satellite positions
- Built-in AutoTracking support for all popular antenna control interfaces including Kansas City Tracker, SASI Sat Tracker, AEA ST-1, Orbit Electronic RIF-PC, Uni-Trac, and the M^2 RC-2800P
- Floating/docking toolbar for easy access to common functions
- Context-sensitive online help
- Multi-level configuration setup screens
- Text listings to screen, printer, or disk file
- Configurable Satellite Script for priority tracking
- Two-satellite mutual visibility, including 1- and 2-observer 2-satellite mutual windows
- Satellite eclipse predictions
- Full Moon data for EME
- 2,000-city, DXCC, and EME databases included
- Fully Year 2000 (Y2K) compliant

System requirements:

- Pentium® or similar fast processor (a '386 or '486 will work, but slowly)
- Microsoft® Windows '95, '98 or Windows NT
- Video: 640x480, 256 colors required; 1024x768, 16-bit color preferred
- At least 12 MB hard disk drive storage for full installation

Installing Nova for Windows

♦ Insert the Nova for Windows CD into the CD-ROM drive of your computer.

♦ If the setup program doesn't start automatically, click on the *Start* button (lower left corner of the desktop).

♦ Click on *Run*.

♦ In the file name box, type **Setup.EXE**.

♦ Follow the directions in the Nova for Windows Setup.

Important:

♦ Be sure to enter the serial number carefully.

♦ Serial number **must** include the NLD- prefix.

Nova for Windows' Views

Nova for Windows displays satellite tracking information in "Views." A View consists of a map, columnar text data, or both together. One or more Views may be visible simultaneously. <u>Each View is completely independent of the others; different Views may contain different satellites, observers, and time/date</u>. A View may include a map, text data, or both at once. NfW may have as many Views active as you desire.

In normal use, two or three Views is usually sufficient, but there is no practical limit to the number of Views that may be open simultaneously. Each View can track an unlimited number of satellites and observers.

Views are created by double-clicking anywhere on the NfW "desktop," by choosing **Views/Create new View** from the main menu, or by clicking on the **New View** button on the ToolBar.
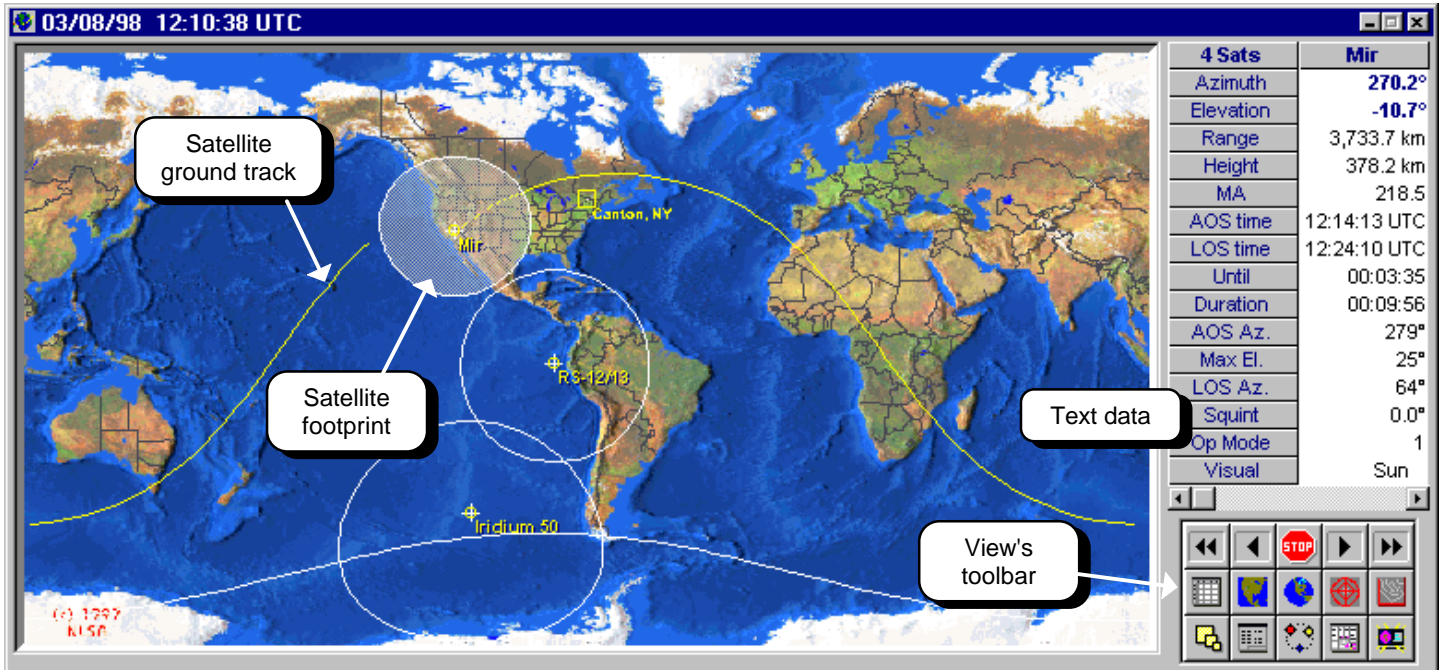
*Nova for Windows' **Views** may contain text, map, or both.*
This View shows a Rectangular-style map and one column of text data.

Text

The text portion of Views displays each satellite's current position as well as a summary of the next pass.

The layout of the text display is dependent on the number of observers currently active in the View. The text displays the greatest amount of information if one observer is specified. Two observers' data are summarized in a format similar to that of one observer but with fewer lines of data for each observer. If more than two observers are included in the View's list then each satellite's current position is listed for each observer.

Maps

Nova for Windows contains four major map types with many user-modifiable attributes in each map:

- Rectangular (modified Miller projection)
- View from Space (Orthographic projection)
- Radar (upper hemisphere stereographic projection)
- Sky Noise (rectilinear RA/Dec projection)

The **Rectangular** map covers most of the Earth; only the poles are omitted. It is convenient for showing the positions of several satellites at once and for displaying satellite footprints for intercontinental communication. The rectangular map can be set to display any longitude at the center. Individual continents can be "zoomed in" for greater detail. On a 1024*768 pixel display, the

4 Sats	Mir
Azimuth	33.1°
Elevation	17.8°
Range	1,036.9 km
Height	376.9 km
MA	246.6
AOS time	12:14:19 UTC
LOS time	12:24:18 UTC
Until	00:03:32
Duration	00:09:58
AOS Az.	279°
Max El.	25°
LOS Az.	65°
Squint	0.0°
Op Mode	1
Visual	Sun

Satellite's "footprint," the area of the Earth visible to the satellite at this moment.

Change the continent at the center of the map by mouse-clicking on a new continent.

Real-time text data concerning the satellite. You can show as many columns of data as there are satellites in the View (see Individual View Configuration/Text columns).

*The **View from Space** presents the Earth in a 3-dimensional perspective.*
You may configure the map to show ground tracks, orbits, and satellite footprints.

single-continent rectangular map displays a resolution of about 10 km per pixel. Land and water are accurately shaded to illustrate elevation and depth, respectively.

The **View from Space** map shows a realistic perspective of the Earth from a position out in space. The land surface is rendered to show topography and the oceans are shaded to indicate water depth. The position is centered over one of the continents. You may change the center continent is one of two ways:

- Left-mouse click directly on the map, on the continent that you want to turn to;

- In the **Map Configuration** screen (from the ⊞ *Configure Maps* button on the ToolBar or the View's pop-up which is activated from the right mouse button).

In addition, you can easily change the "distance" from which the Earth is viewed by clicking the left mouse button out in space, away from the Earth's image.

Information about any satellite visible on the View from Space maps may be displayed by clicking the left mouse button on the satellite's image.


```
STS-83                          ×
Azimuth  : 224.0°
Elevation: -20.8°
SSP Lat  :    5.5°N
SSP Lon  : 105.9°W
Range    : 5,260.4 km
Height   :   302.4 km
Next AOS : 13:36:33 Loc
Next LOS : 13:40:11 Loc
Until    : 03:19:19
Duration : 00:03:37
      Make AutoTracking Sat
```

Pop-up information about a satellite is available simply by clicking on its name.
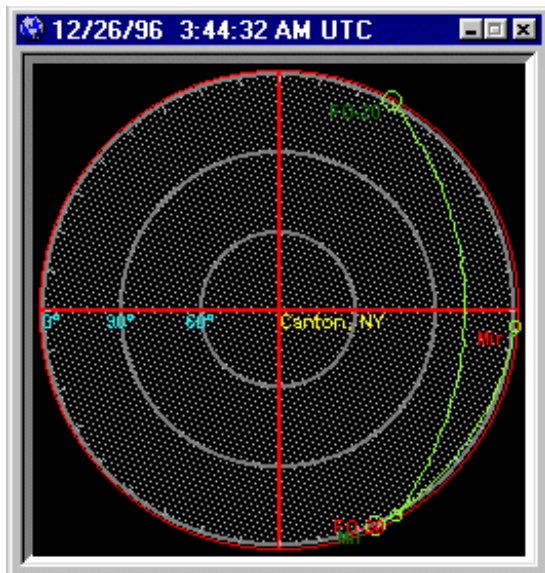
*Nova's **Radar** map shows a full view of the Observer's sky. Overhead is in the center of the Radar map.*

The **Radar Map** is a Northern Lights Software innovation. It displays a view of the sky with the observer at the center, similar to a radar station. North is at the top of the map, east to the right, etc., just like a compass. The outer perimeter of the Radar Map represents the observer's horizon and the center of the Radar Map is directly overhead. As a satellite becomes visible, it appears on the map's perimeter and passes inside the circle. The higher the satellite gets in the sky, the closer to the center of the map it appears.

Like all maps, the Radar Map is configured in the Map Configuration screen. Upcoming passes can be displayed as arcs across the map. The rise-point of a pass is shown as a larger circle and the set-point is a smaller circle; this permits you to easily visualize the direction that the pass will travel across the sky.

You have control over its appearance, display of upcoming passes, antenna position, as well as the size of the Radar Map itself.
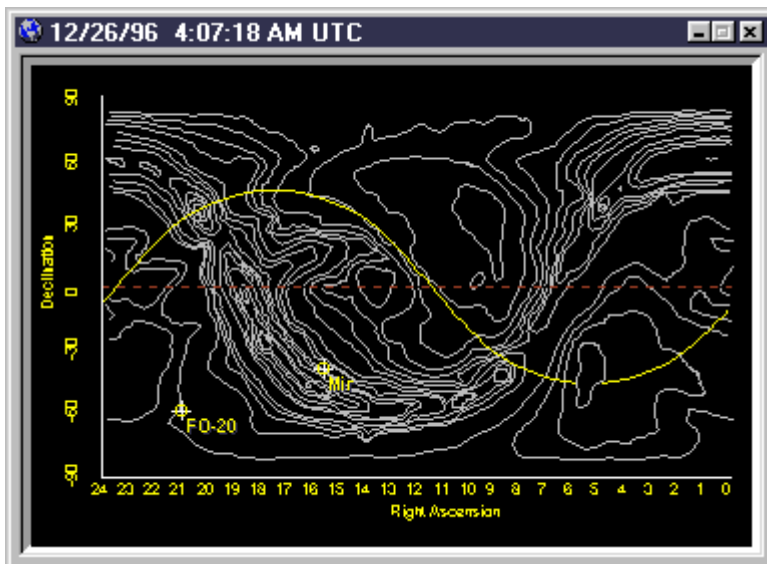
*The **Sky Temperature** map shows noise sources across the sky. It is especially useful for E.M.E.(moonbounce) because sky noise can obscure weak signals.*

The **Sky Temperature Map** portrays the sky's "equivalent noise temperature." Random noise, generated by the billions of stars in the universe, is more concentrated in some parts of the sky than others. The lines on the Sky Temperature map are contours (similar to contour lines on a topographic map) that show areas of higher and lower amounts of sky noise.

This information is useful in situations where desired signals from space are extremely weak. If the source of the signals (for example, an artificial satellite or moonbounce signal) is "in front of" noisy areas, then the signals are much more difficult to detect.

Nova for Windows includes Sky Temperature maps derived from IEEE measurements at three frequencies: 50, 137, and 400 MHz; these correspond well to the amateur 6-meter, 2-meter, and 70 cm bands.

The axes of the Sky Temperature map are familiar to astronomers but perhaps not to satellite users. The vertical axis is Declination, which is the angle between the item of interest and the celestial equator (the imaginary extension of the Earth's equator into space). The horizontal axis is in Right Ascension. This represents the angle measured in hours (1 hour = 15°) between the item of interest and 0° longitude at Greenwich, England.

Configuring Views

The appearance of Nova for Windows is determined by the Views that you have launched. Views are configured separately from one another. Changes made to one View do not affect others.

Initial configuration of Views may be challenging at first, but it quickly becomes easy once you are familiar with the View pop-up menu. To bring up the View pop-up menu and configure a View, position the mouse over the View and press the right mouse button.

Open the pop-up by right-clicking anywhere on a View

For detailed configuration, such as choosing satellites and observers, select **Configure View** from the pop-up. This will display the *Individual View Configuration* screen. Page 19 explains the Individual View Configuration screen.

View's Clock sets the time for the View. This time can be the same as for the overall Nova for Windows program or it can be entirely different. By default, View time is the same as Nova's time. To set the View's time to a different value, click the **Stop** button and enter the desired values in the spin boxes. To set the View's time to Nova's time, click **Reset**.

Small steps and Large Steps indicate the time jumps when the time-stepping arrows on the View's toolbar are pushed.
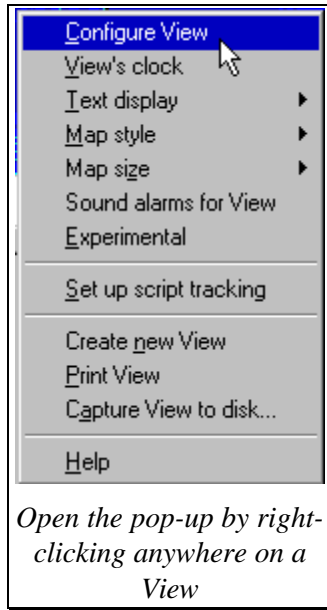
Text Display determines whether the View's text is normal (one column of text data for each satellite, placed to the right of the map), Script tracking (automatically changing as each satellite in the Script becomes visible), or no text at all.

Map Style set the kind of map that will be displayed in the View's map section. The map may be Rectangular, View from Space, Radar, Sky Temperature, or no map.

Map Size: Nova for Windows accommodates several screen resolutions. Views may be sized to fit the screen that you have. Small is appropriate for 640*480 pixel screens, medium for 800*600, and large for 1024*768.

Sound alarms for View are explained on page 40.

Experimental is explained on the following page.

*Nova for Windows' quick time-step buttons appear on each View. Their step size is set in the **View's Clock** screen*
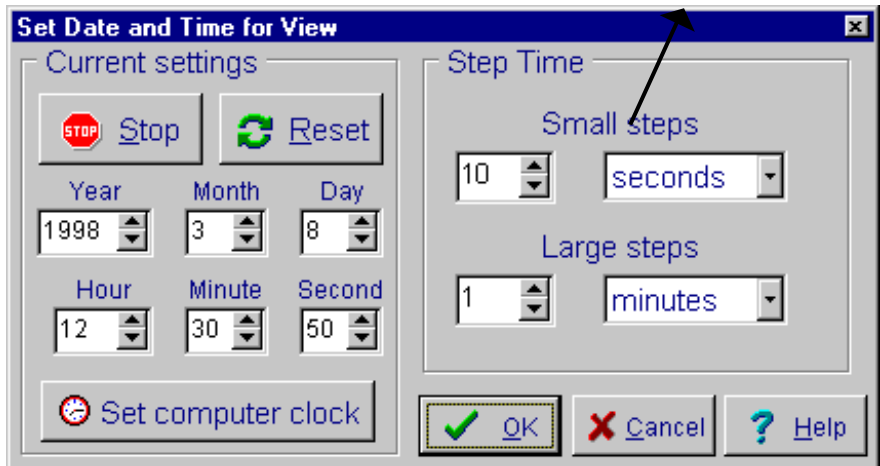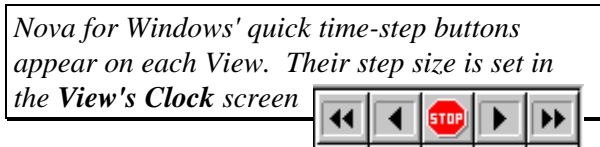
Each View's internal time can be set independently from that of other Views'

Note: The *Set Date and Time for View* screen (shown here) is *not* the place to set Nova's time or, typically, the computer clock. To set Nova's overall time, use *Setup/Time* from the Main Menu.

Experimental mode is a tool for examining the effects of changes in Keplerian elements on satellite orbits. Using the Experimental Mode, orbits can be adjusted in real time and the effect on an orbit can be seen immediately. For example, what would the orbit of the Russian "Mir" space station look like if its inclination was 10° higher and its eccentricity was 0.1?

Experimental Mode is entered via the View pop-up menu described on the previous page. *The satellite used in this mode is the first satellite on the View's satellite list*. Buttons at the bottom of the Experimental Mode screen allow you to retrieve different satellites or to save the results of changes made in this screen.

Experimental elements	☒
Satellite name	Feng Yun1-2
Catalog number	20788
Epoch time	97079.18868160
Element set	284
Inclination	98.8200
RA Asc. Node	81.2144
Eccentricity	0.0015085
Arg. of perigee	85.3638
Mean anomaly	274.9477
Mean motion	14.01410822
Decay rate	0.00000109
Epoch orbit #	33475

🖳 Save   √α Derived   📇 Restore
🛗 Close   ？ Help

The **Derived** button enables examination of several values such as apogee and perigee altitude, period, etc. A more visual approach is to configure the parent View to display the View from Space with an orbit displayed. Then, as changes are made in Keplerian elements, the orbit's shape changes immediately.

The key to a satellite's identity is its *catalog number*. Changes made to the satellite's catalog will permanently change its identity and prevent Nova from updating its Keplerian elements from an external file.

Entries in the *Element set* and *epoch orbit* # fields have no effect on a satellite's orbit calculations.

Setup/General (picture on following page)

The *General* setup screen provides access to settings that concern all of the Nova program. These settings will affect the overall Nova screen display as well as performance. Settings are retained between sessions.

Tracking Algorithm The Plan-13 algorithm by James Miller is a simplified version of SGP4 which is very fast and sufficiently accurate for most applications. SGP4/ SDP4 uses the two-part (near-Earth and deep-space) model presented in SpaceTrack Report #3 and re-coded from the original FORTRAN by Lt. Col.. T.S. Kelso, Ph.D. of the U.S. Air Force. SGP4/SDP4 employs general perturbation theory to provide highly accurate prediction of orbital positions. SGP4/SDP4 is more time-consuming and should be used only if high accuracy is needed. SGP4/SDP4 is also useful if Keplerian elements are old because it more accurately accounts for long-term effects of gravitational and drag forces.

Distance units: select between English, metric, or Nautical units. These units will be used throughout Nova for Windows.

View style: "*Free-floating views"* may be placed anywhere on the Windows desktop. A thin Main Menu bar for NfW will remain, providing access to control functions. This option permits fast switching of focus between NfW and other programs but it may result in a cluttered screen. "*Contained views*" means that all Views are confined to the Nova screen, which may be minimized if desired. This option generally results in the most pleasing screen display if Nova is the only program being run.

Show hints in setups controls whether small pop-up hints appear when the mouse rests on a button or other control for more than two seconds. These hints are useful when you are first learning to use Nova but you may want to turn them off after you are familiar with the program.

Include refraction correction instructs Nova whether to correct satellite elevation angles for the effects of atmospheric refraction. This effect is always small, becoming entirely insignificant above about 5° elevation. There is a slight speed penalty for including refraction correction.
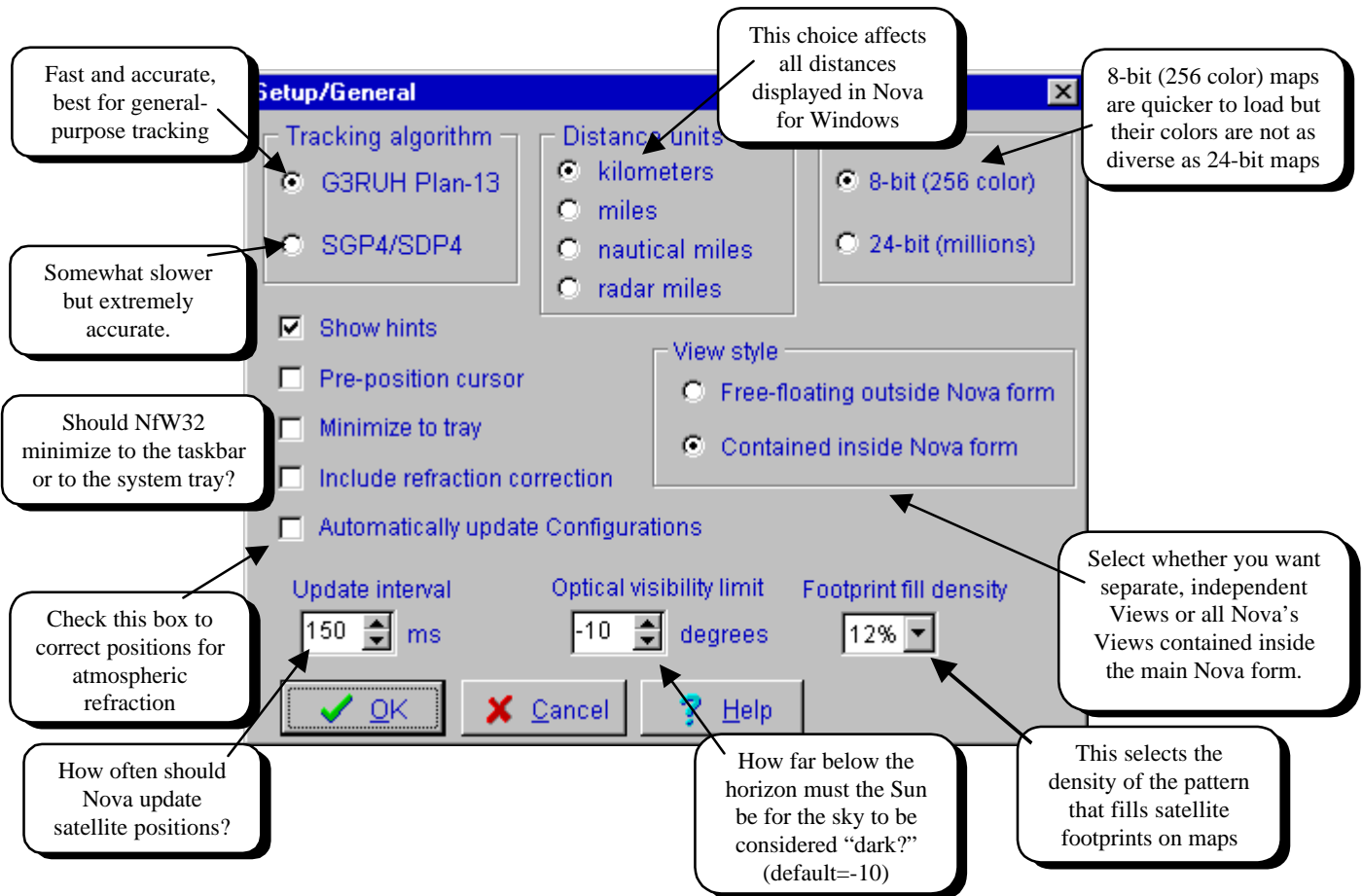
*Use **Setup/General** for items that apply <u>throughout</u> Nova for Windows*.

Update interval controls how often Nova updates its on-screen display. A small value results in faster updates but may consume more computer CPU time than desired. A value of 150, which results in 4-6 updates/second on a Pentium-120 MHz, is a reasonable compromise between speed and CPU loading. Use a larger number if other programs appear to run sluggishly.

Optical visibility Limit determines how far below the Observer's horizon the sun must be for conditions to be "dark." This adjustment is necessary because nightfall does not occur exactly at the moment of sunset. A larger value for this setting means that the sky will be darker before NfW consider it to be "night." This setting only affects calculations related to visual observation of satellites.

Footprint fill density selects the density of the fill pattern used for satellite footprints. A high density is easier to see but it may obscure features on the map underneath. A value of 25% is usually good.
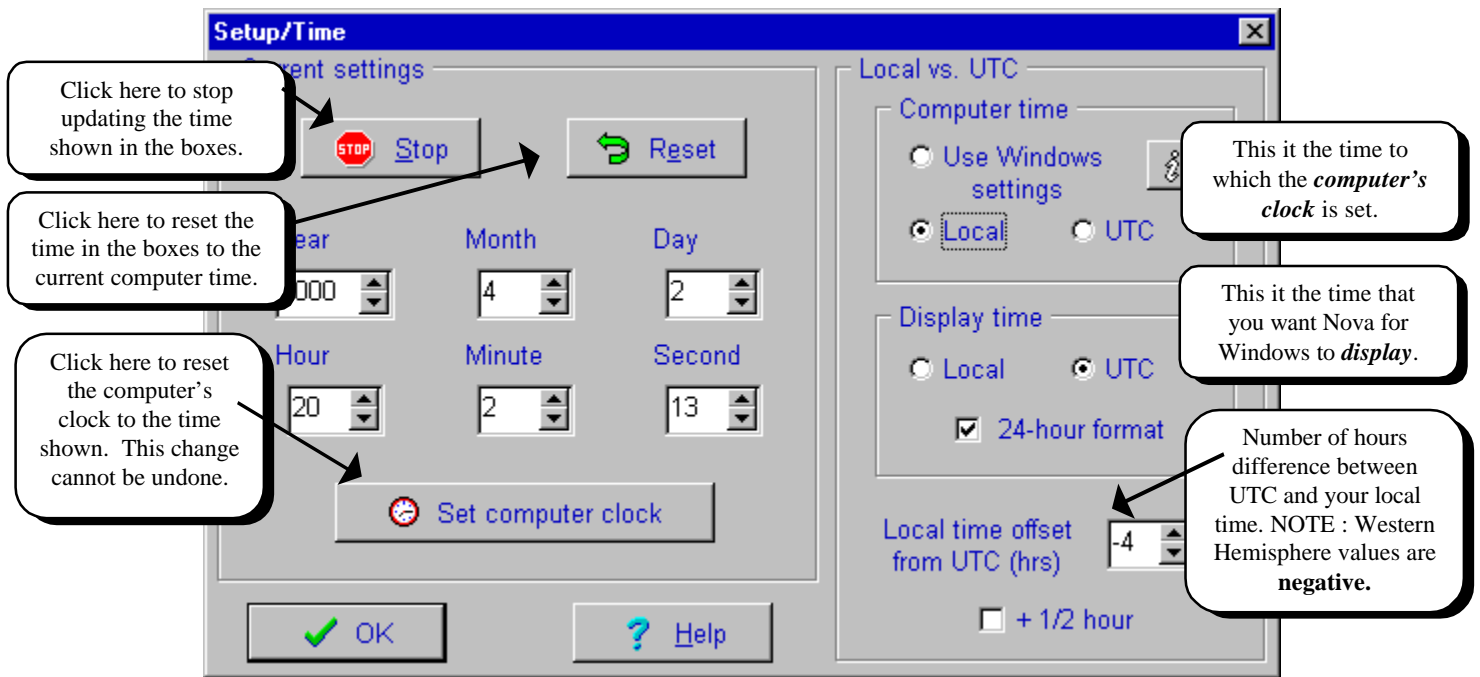
Correct timekeeping is essential for accurate satellite predictions.
Make sure that Nova for Windows is correctly configured for your system.

Setup/Time

This selection provides access to your computer's date/time clock. Every computer has an internal clock that keeps track of the date and time. This clock is the basis for all of NfW's satellite predictions so it must be set accurately. It is wise to check the clock at least once a week to make sure that it remains accurate; some computer clocks drift many seconds per day.

The *Current Settings* display shows the current date and time as reported by the computer to the Windows operating system. To change the displayed values, first click on the Stop button to prevent continued updates. Then enter new values in the appropriate boxes. If you want to reset the computer's clock to the new values, press the Set Computer Clock button. To reset the

Current Settings display to the computer clock (after making changes but before setting the computer clock), click on the Reset button.

The *Local vs. UTC* box tells Nova how to interpret the time and date that it retrieves from Windows. Check the appropriate boxes to tell Nova whether your computer clock is set to local time or UTC, and whether you wish Nova's display to be in local time or UTC.

If "Local" is selected for either the computer clock or Nova's display, a "*Local time offset from UTC*" value must be entered in the lower box. This value represents the number of hours difference between your local time and UTC. If your local time is behind UTC, then the offset is negative.
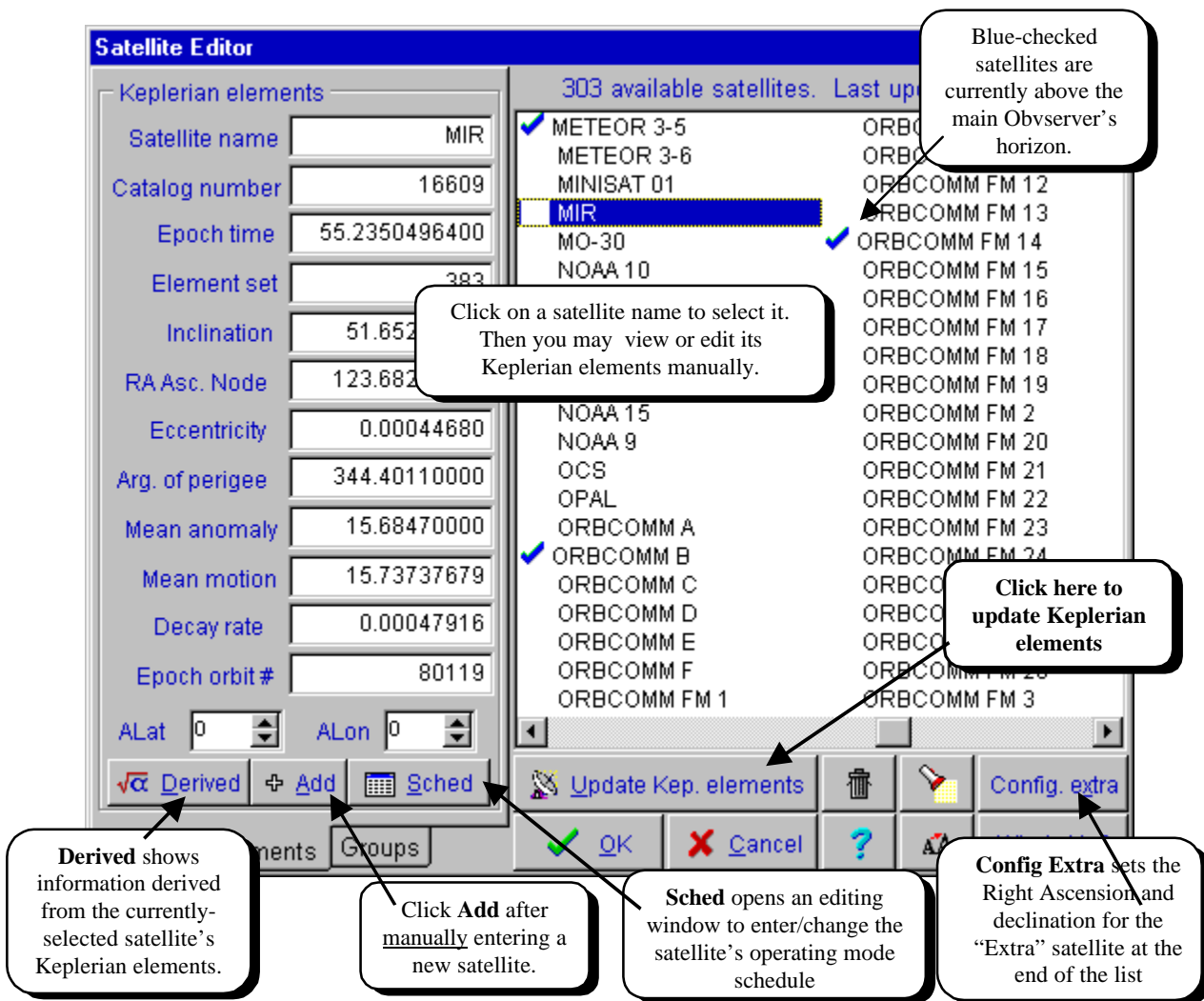
Setup/Satellites is the place to update Keplerian Elements

Setup/Satellites

The **Setup/Satellites** display consists of two "pages," Keplerian Elements and Groups. These will be described separately although they share a common Main Database.

The *Setup/Satellites/Keplerian Elements* page in Nova for Windows provides a means to update Keplerian elements smoothly and easily. The large list on the right of the screen contains all of the satellites in Nova's database. There is no practical limit to the size of this database but a large number of satellites requires longer time to load and process.

Keplerian Element page contains edit boxes on the left side of the Setup/Satellites page. These boxes provide the option of manually changing individual Keplerian Elements. Select the satellite whose elements are to be edited by clicking on the satellite's name in the main

database list. Be cautious when manually editing these values because some values may cause the satellite to "crash" or its calculations to make Nova unstable.

NOTE: Each satellite's Catalog Number is unique and is used to identify the satellite internally within Nova. If the Catalog Number is changed, the satellite will be treated as a new satellite and added to the Nova database.

A very small number of satellites are positioned by ground controllers so that the satellite's antenna points in a particular direction relative to the satellite's orbital plane. For these satellites, values of **ALat** and **ALon** describe the "attitude" (orientation) of the satellite's antennas. Alat and Alon are not provided in standard Keplerian Element sets so their values must be entered manually. Most satellites need no ALat/ALon entries.

How to Update Keplerian Elements

Keplerian Elements are numbers that describe the position and velocity of a satellite at a single instant in time. "Keps," as they are sometimes called, are generated by ground-based radar ranging stations operated by governments and the military.

Keplerian elements are used in satellite-tracking calculations to predict the position of a satellite at some time in the future. Nova for Windows combines Keplerian elements and the current time/date from the computer to determine the satellite's current position. Nova then uses the observer's location to compute the satellite's azimuth, elevation, and other values from that spot on the Earth's surface.

> **Nova for Windows offers several ways to update Keplerian elements:**
>
> ♦ From the **Main Menu**
>   ▪ Disk file
>   ▪ Internet/FTP
> ♦ Drag-and-Drop
> ♦ Setup/Satellites screen
> ♦ Timed update from disk file

Keplerian elements may be acquired from a number of sources. Current Keplerian elements are provided at many Internet sites. One of the most widely used sites is **http://www.celestrak.com** maintained by Dr. T.S. Kelso.

How often do you need to acquire new Keplerian elements? The answer depends on your requirements and your ground-station characteristics. For almost all applications, updating Keplerian elements once a month is entirely sufficient. Users of Low Earth Orbiting (LEO) satellites who need very accurate positions might need to update every two weeks whereas higher-altitude satellites' elements are usable for several months. Maneuvering satellites, such as the U.S. Space Shuttle or the Russian Mir space station might need daily updates of Keplerian elements.

Keplerian elements must be up to date if Nova for Windows' calculations are to be the most accurate. For LEO (Low Earth Orbiting) satellites, elements should be updated every few weeks, perhaps every week if the greatest accuracy is needed. For higher altitude satellites, frequent updates are less critical.

A convenient set of updating options is available from the Main Menu/Kep. Elements. Disk file update selection are:

Quick update from file updates NfW's internal database from an ASCII text file with the same name that was used in the last (previous) Manual update. For example, if you specified a file named *c:\keps\LatestKeps.TXT* when you last used Manual updating (see below), that same file name will be used with Quick Updating. This feature is useful if you always download the latest Keplerian elements to exactly the same file name.

Manual update from file permits specifying the file name and several less-used options. Quick Update (above) uses these settings.

Timed update from file. This selection is useful in situations where a network receives new Keplerian elements via e-mail and automatically copies them to a disk file. The same disk file name must be used every time. NfW checks the date/time stamp on the file and updates the satellite database whenever a new file is detected.

FTP (Internet) update: Using this option, you can download one or more new Keplerian element files from the internet and update Nova for Windows' internal database in one step. In order for FTP to operate, an internet connection must be available. This may be accomplished via a dial-up Internet connection or through a hard-wired LAN.
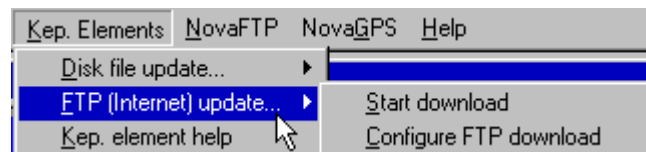
Start download begins FTP download immediately. The files that will be downloaded are selected in the **Configure FTP download** screen.

Drag and Drop is an easy method of updating Keplerian elements if you have already acquired an ASCII text file containing new elements. With Nova for Windows running, simply drag the file from the Windows desktop or Windows Explorer onto the Nova screen. Nova will automatically recognize the file and attempt to update its internal database.
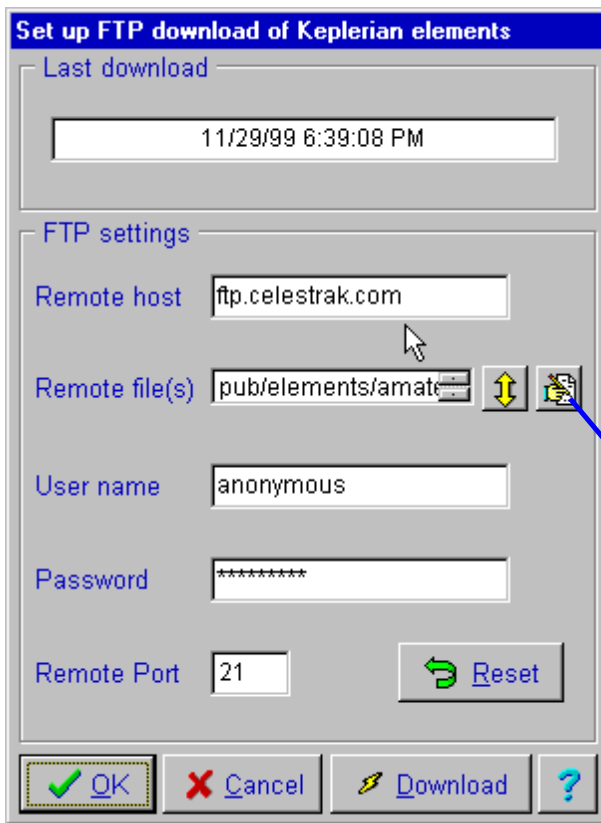
Remote Host is the FTP site which will supply files containing new Keplerian elements. We recommend ftp.celestrak.com because the files are up to date, accurate, and reasonably sized. Other sites are also available.

Nova for Windows can download multiple files from an FTP site and build a single local file from the separate FTP files. **Remote files** contains a list of the files that will be downloaded. These are the files whose names are checked in the Select remote files window (below). File names must contain the full directory path and complete file name for each file. Case is important for FTP.

Clicking on the Select files button opens another window where files may be selected for download. Items that are checked will be downloaded. You can add, delete, and edit file names in this list.

To edit an entry, click on it and make changes in the Remote file name box. After making changes, click the Replace button.

User name, **Password**, and **Remote port** are usually not needed and can safely be ignored. A few sites may require you to enter your e-mail address and a password, but this is almost never required.

Setup/Satellites method

This screen is presented when you press the **Update Keplerian elements** ⬛ Update Kep. elements button from the Setup/ Satellites or Setup/Groups screen.

⬛ Update If the new database contains data for satellites that are not already in your NfW database, the new satellites are added automatically.

A pop-up dialog box will prompt you for the name of the computer file containing new elements. This file may be in either the "NASA 2-line" or "AMSAT" format. Nova will read the file and automatically determine its format. Header text, which often accompanies files downloaded from the Internet, is ignored. Nova reads the new file and updates the Keplerian elements for all satellites in its database that match entries in the new file. For example, if Nova contains entries for fictitious satellite A, B, and C but the new file only contains elements for A and B, then C's elements will remain unchanged. On the other hand, if the new file contains elements for additional satellites, then they are automatically added to Nova's database. In the preceding example, if the new Keplerian element data file contained entries for A, B, and D, then Nova's database would add D automatically. This may be useful if you have access to a variety of elements in small files but it may lead to an accumulation of unneeded satellites after some time

🚫 Don't Add If the new database contains data for satellites that are not already in your NfW database, the new satellites are NOT added automatically. No satellites are removed from, or added to, your existing NfW database.

Update Keplerian elements

⬛ Update — Update Keplerian elements, adding new satellites to NfW's database

🚫 Don't Add — Update Keplerian elements but do not add new satellites to NfW's database

☐ Ignore checksums
☑ Preserve satellite names

⬛ Clean — Update Keplerian elements and remove any non-matching entries from NfW's database

⬛ FTP — Update Keplerian elements via the Internet using FTP

⊗ Timed — Set up regularly-scheduled updates of Keplerian elements from a disk file

⬛ Close   ? Help

⬛ Clean The Clean button acts the Update button except that any satellites in your existing database that are absent from the new database will be removed. In other words, after a Clean operation, there should be a one-to-one relationship between the main NfW Database and the satellites in the new Keplerian Element file.

Timed updates of Keplerian elements

☐ Enable regularly timed updates of Keplerian elements from a disk file

Full file name
c:\novawin\data\nasa.dat

Update interval   **Update now**
30 ⬍ minutes ▼   ⚡

☑ Update only if file date has changed

Last update   --- not initialized ---

Prev. file date   --- not initialized ---

✓ OK   ✗ Cancel   ? Help

Automatic updates of Keplerian elements from a disk file are configured with this screen

⬛ FTP The FTP button opens another window where you can configure and begin down-loading of new Keplerian elements via the Internet. This function uses "FTP" protocol. You must have an internet connection for this function to operate.
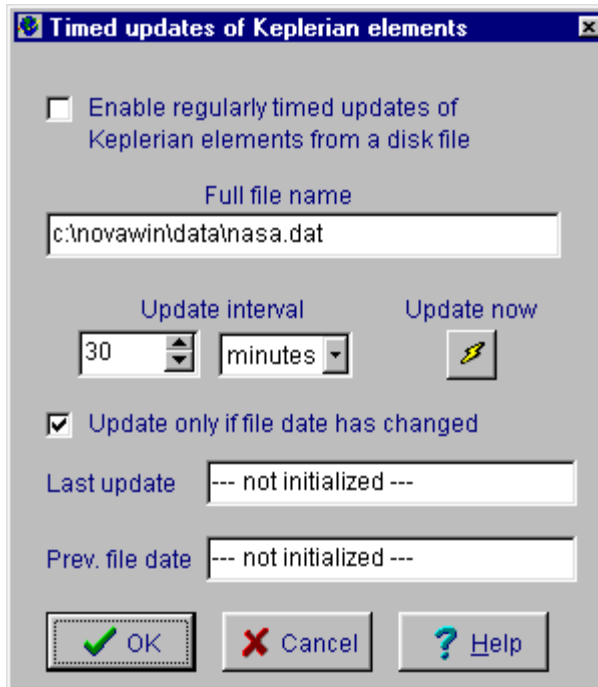
⊗ Timed The **Timed Update** function automatically reads a specified text file at a regular interval and attempts to update Nova for Windows' Keplerian element database. This function is useful if you have new Keplerian elements

delivered automatically and if they are copied into the *same file name* each time.

Ignore checksums means that Keplerian elements will be accepted even if the checksum digit is incorrect. Checksums are used to indicate errors in data sets, so use this option with caution.

Checking **Preserve satellite names** will tell Nova for Windows to keep any existing satellite names even if the new Keplerian element file contains different names. For example, if you like the name "Oscar 10" but the new Keplerian element file calls it "AO-10," then checking this box will let the name remain as "Oscar 10."

.

Setup/Groups

> *Groups* *are collections of satellites that have something in common. You create and edit your groups in* ***Setup/Groups***

Nova's *Groups* are user-defined associations of satellites. They are provided as a convenience for accessing similar satellites together. For example, all weather-related or amateur-related satellites might be placed in a Group. You may have as many Groups as desired and each group may contain an unlimited number of satellites. For the sake of practicality, however, we recommend that groups contain fewer than 25 or 30 satellites.

This page shares its Main Database with the Keplerian elements page.

The Groups page of Setup/Satellites creates and edits Groups. Groups are collections of satellites that are defined by the user. They have no direct connection with any View but are merely a convenient way to "grab" similar satellites at one time. Clicking on a name in the Groups box will display the members of the Group in the box below.

Groups are created with the **Add** button. The group is named and at first it contains no satellites. Select the satellites of interest with the mouse and drag them to the Group members box. Entries in the Group members box may be deleted or rearranged with the mouse as well.

To delete satellites from a Group, select the satellite name with the mouse and then click the **Delete** button. You may rearrange the members of a Group by dragging their names with the mouse.

Select Sats opens the **Satellite Selector** shown on the following page. This feature permits advanced users to sort through Nova's entire satellites database and extract satellites meeting certain criteria. For

Satellite Editor
Groups
Ham Sats
Weather Sats
GPS Sats

You may have as many groups as you wish

+ New | Rename | Delete

Group Weather Sats members
NOAA 10   Meteor 2-20
NOAA 11   Meteor 2-19
NOAA 12   Meteor 2-18
NOAA 13   Meteor 2-17
NOAA 14   Meteor 2-16
NOAA 9
Meteor 3-6
Meteor 3-5   These are the satellite
Meteor 3-4   "members" of the
Meteor 3-3   selected group
Meteor 3-2
Meteor 2-21

Select Sats | Delete

Groups Keple

Select satellites by certain criteria based on orbital elements (for advanced users)

example, a particular application may require selection of all satellites with, say, certain eccentricity or mean motion. Use the tabs across the bottom of the page to choose which rule to modify (Eccentricity, Inclination, Period...). For each rule, select whether you want **Any** value to be all right or if the value must fall **Between**, **More than**, or **Less than** the limits that you set in the edit boxes.

To effectively ignore the value of any quantity, select *ANY* as the rule. For example, choosing *ANY inclination* means that *ANY* is ignored in selection when inclination is evaluated.

Finally, in the **Relations** box, select whether you want all the rules to be met simultaneously (**AND**) or whether meeting any rule (**OR**) will be satisfactory. For example, saying "Eccentricity Greater than 0.01 *AND* Inclination Greater than 50°" means that a satellite must

meet both criteria, whereas OR means that if it meets either the Eccentricity *OR* the Inclination criterion, the pass will be selected.

> Note: If *OR* is used as the Relations operator, then setting *any* rule to *ANY* will mean that <u>all</u> satellites in the list will qualify for selection

It may require some experimentation to learn to use the Satellite Selection facility. After you have become familiar with it, you may want to use it to select satellites for a Group. Pressing the **New Group** button will cause the selected satellites to become a new group, just as if you had dragged each satellite from the master database list manually.

Satellite Selector

Summary

Eccentricity	between 0.010000 and 0.040000
	AND
Inclination	Any
	AND
Period	Any
	AND
Next AOS	Any
	AND
Duration	between 5.0 and 15.0 min.
	AND
Apogee	Any
	AND
Perigee	Any

5 sats

FO-29
MACSAT 2
OFEQ 3
SAMPEX
Starlette

Summary of selection rules

These satellites fit the rules

Choose between AND & OR for relations between limits

Rules : Duration

Set selection rules and limits

○ Any (ignore)

minutes

◉ Between.. { ○ More than... [5.0] / ○ Less than... [15.0] }

Relations

◉ AND

○ OR

[Select sats]

Eccentricity | Inclination | Period | Next AOS | Duration | Apogee | Perigee

✓ OK   ✗ Cancel   New Group   ? Help

Select which rule to modify

Create a new Group from the satellites selected here

Start the selection based on current rules & limits.

Nova's Satellite Selector is used to build groups based on their orbital characteristics.
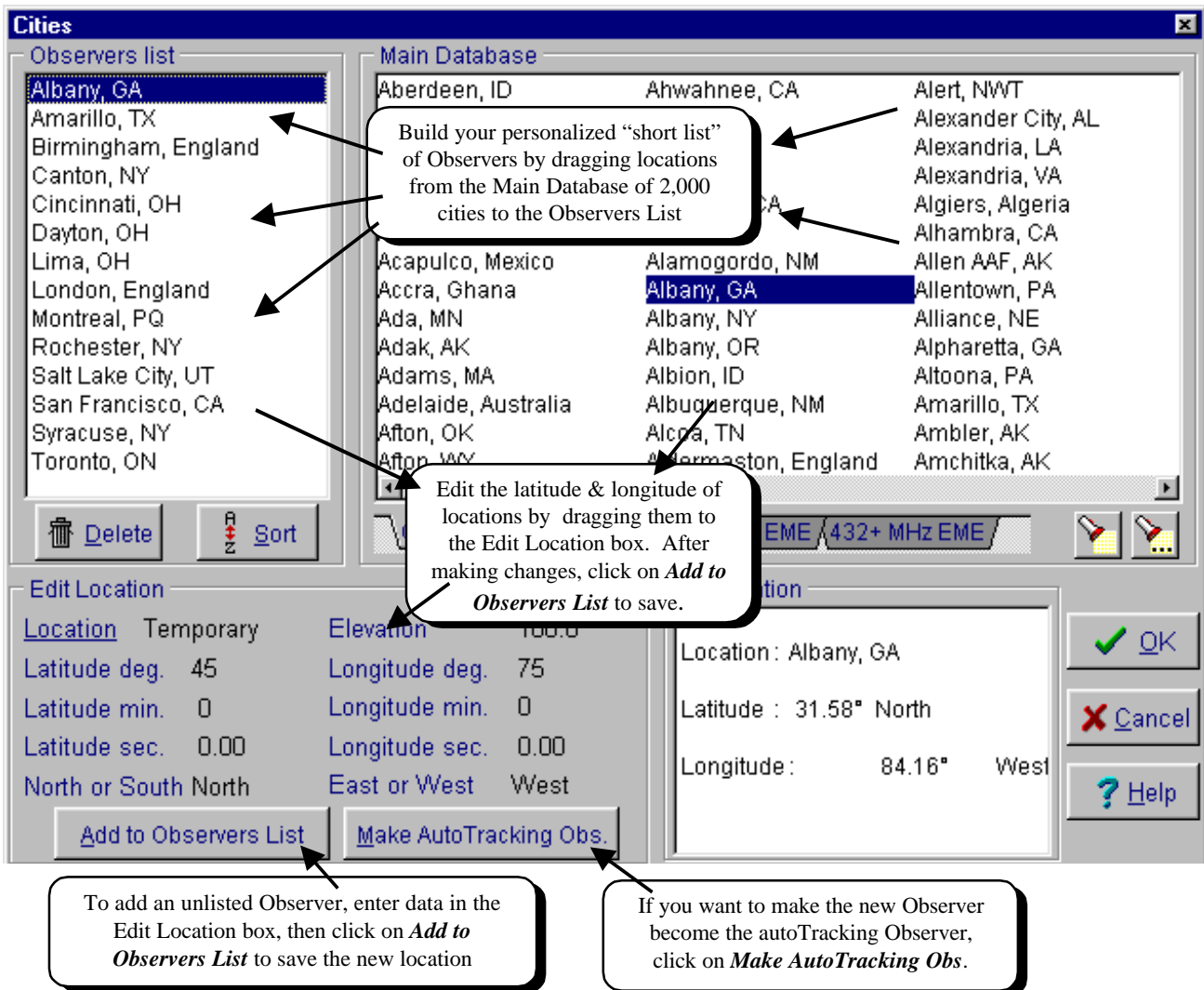
*Use **Setup/Observers** to build your personalized "short list" of observer locations.*
Each View's observers are set in the Individual View Configuration Screen
by selecting from the "short list."

Setup/Observers

The Setup/Observers screen presents Nova's database of observer locations. Nova's observer database is maintained in two parts: the *Main Database* which contains thousands of cities, hundreds of countries, and hundreds of moonbounce entries, and a short *Observers list* of observers that are user-selected. The short list is shown on the left of the Setup/Observers screen. *The Observers List is used in configuring Views instead of presenting the entire Master Database*.

Customize the Observers List to suit your needs. Observers may be taken from any of the four Main Databases or you may manually enter latitude/longitude data in the edit space in the lower left of the screen. Add or delete Observers to/from the Observers list by

drag-and-drop. Search for locations in the Main database by using the **Find First** and **Find Next** speed buttons (with the flashlight icons).

To enter new locations, mouse-click on individual lines in the editing region (lower left) and enter the appropriate values. When the entry is complete, press the **Add to Observer List** button to place the new location in the Observers Box. If you wish to make the newly-entered Observer become the Observer used for AutoTracking calculations, press the **Make AutoTracking Observer** button. It is essential that the AutoTracking Observer accurately reflects your exact position. Make sure that your location is entered carefully and then transferred to the AutoTracking Observer.
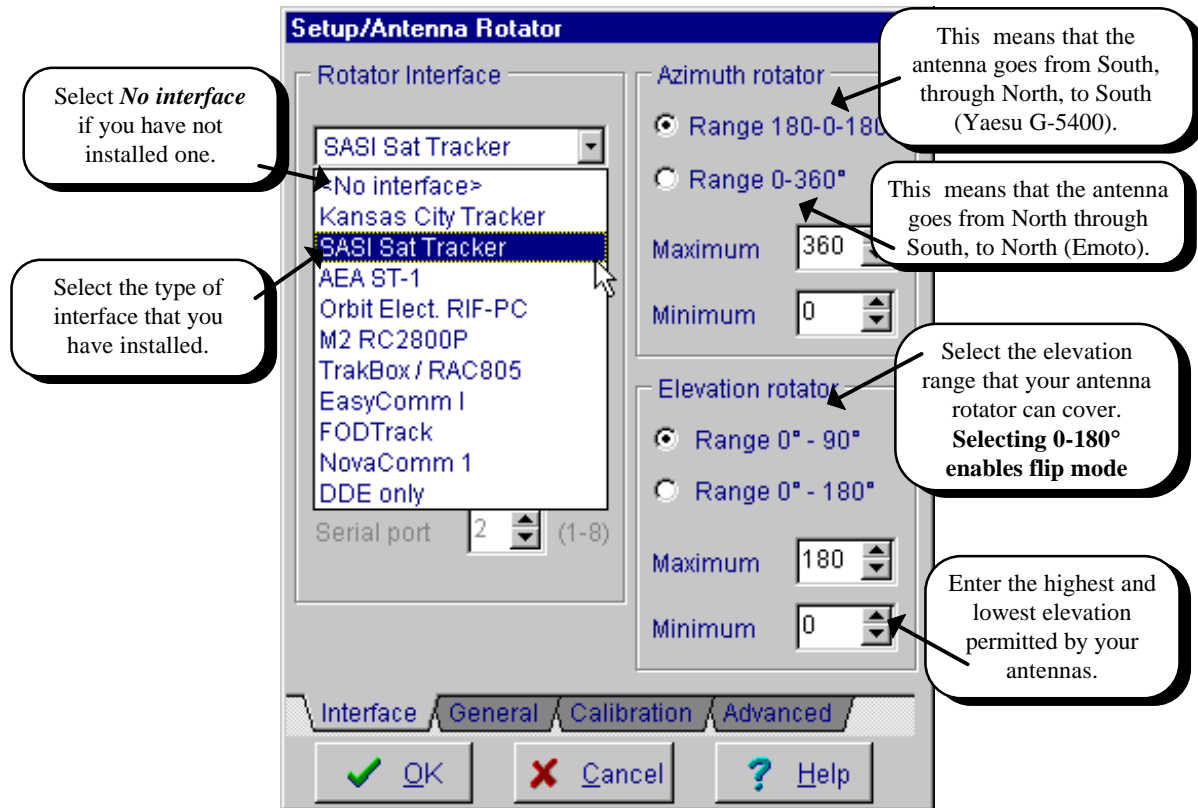
*Accurate and reliable AutoTracking depends on proper setup and calibration
in the **Setup/Antenna rotator** screen.*

Setup/Antenna rotator

Nova for Windows is capable of working with a hardware interface to control azimuth-elevation antennas rotators. Currently, Nova contains drivers for ten interfaces. The SASI Sat Tracker and ST-1 communicate with the computer via a parallel ("printer") port whereas the Kansas City Tracker is an internal card. The RIF-PC is an internal card with 10-bit precision.

Setup/Antenna rotator contains four pages. The **Inter-face** page tells NfW what sort of hardware interface you have, if any. For the SASI Sat Tracker, AEA ST-1, and RIF-PC, you should also select the appropriate port number (1-4). If your computer has the parallel port at a non-standard base address, enter it in the *Base Address* box.

The **Azimuth rotator** box contains selections of north-breaking or south-breaking antennas. "0-360" means that the azimuth antenna travels from 0-360 degrees; the antenna points north at either end of the rotator's travel. "180-0-180" means that the antenna travels from south, through north, to south; north is halfway through the antenna's travel. Emoto and several other brands of rotators are north-breaking whereas the Yaesu G-5400/5600 series antenna rotators are south-breaking.

In the **Elevation Rotator** box, select whether the elevation rotator and the antenna which it controls are capable of elevation angles greater than 90°. If the antennas can elevate to 180°, Nova will automatically use "flip-mode" during passes that require it.

Important

As supplied from their manufacturers, some interfaces are accompanied by "TSR" software to establish communication between a DOS computer program and the interface. *Nova for Windows does not need, and will not use, these software "drivers."* Instead, NfW communicates directly to the interface and does not use the TSRs at all. Therefore you should ignore the TSR software drivers that are supplied with the interfaces. Do not install them and do not use them. If TSR drivers are already installed on your system (perhaps inherited from a previous tracking program), they should be removed because they might conflict with NfW's communication with the antenna controller interface.

Flip mode means that the antennas will begin a pass "upside down" and will gradually right themselves as the pass proceeds. Flip mode is useful for passes whose path crosses the break-point for the antenna's azimuth rotator because flip mode avoids the 360° azimuth spin as the rotator hurries from one end stop to the other. Also in the Elevation Rotator box, you may set the minimum elevation for tracking. This value is usually 0° but you may select another value if, for example, the antennas are limited to a higher minimum elevation for some reason.

General Page

Antenna azimuth & elevation offset : these values compensate for mis-aligned antennas. The values are added to the reported azimuth or elevation in order to correct them for the antenna's true position. for example, if the antenna controller reports that the azimuth antenna is pointed at 90° but the antennas is actually pointed at 93°, then an offset of +3 should be entered as the azimuth offset. Note that the offset values will not compensate for non-linear potentiometers or inadequately calibrated antenna rotators.

Checking the **Preset Antennas before AOS**: box will cause the antennas to move to the satellite's expected AOS azimuth at the specified time before the pass begins. If antennas are preset then they are ready for tracking just as the satellite rises above the horizon and there is no delay in beginning AutoTracking. The time is selected in the spin box and the elevation may also be set. Most situations use 2 minutes and 0° elevation.

Park Antenna when exiting: Checking this box will cause the antennas to be moved to the Park position (selected in the accompanying spin boxes) when Nova for Windows is closed.

Show StatusBar Keypad included buttons on the AutoTracking StatusBar for mouse control of antenna movements.

Show Time Slider reveals a slider on the Status Bar so that you can tweak the AutoTracking time by up to +/- 30 seconds. This is useful for bringing the antennas into better alignment with satellites by permitting the antenna to lead them by a small amount.
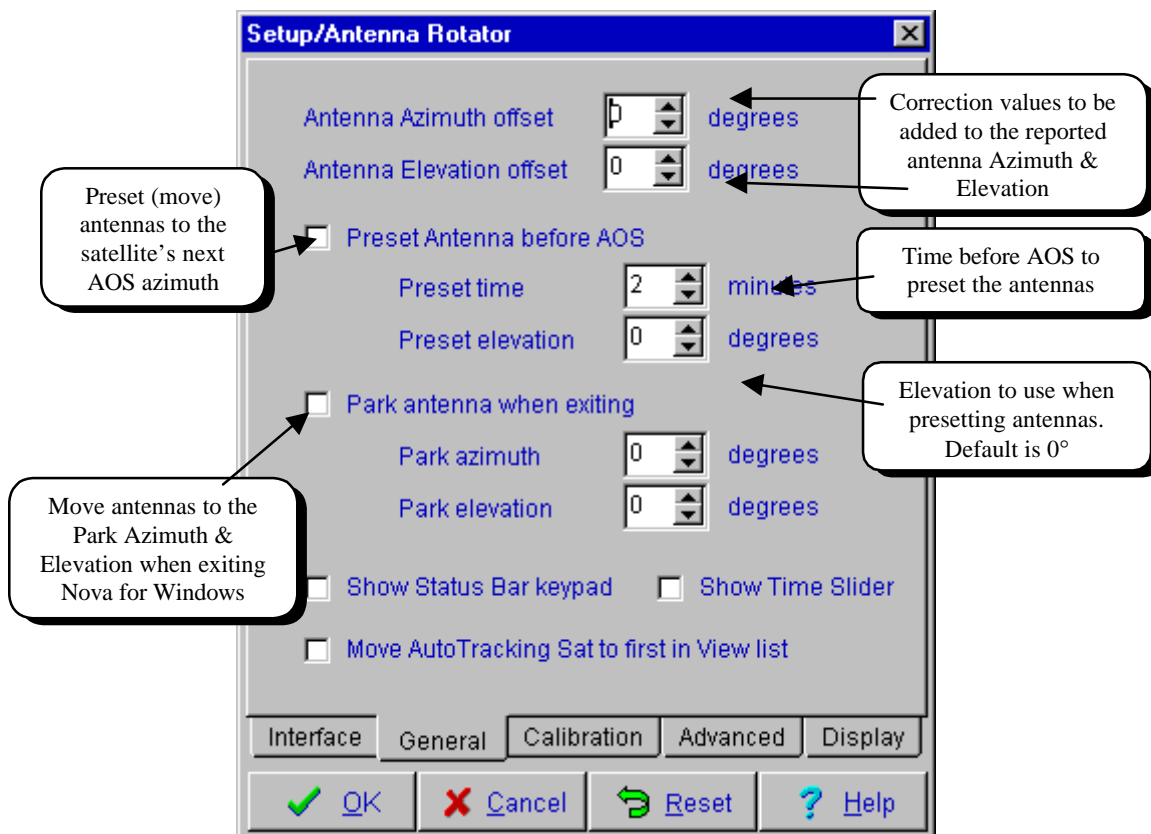
General page of Setup/Antenna rotator notebook

Actual readings from the interface

Elevation

Raw A/D Reading `48` (0-255)

Step 1: Enter the raw A/D reading at minimum elevation

@ Minimum Elevation

A/D Reading `0`

Step 2: Enter the actual minimum antenna elevation

Elevation `0`

Step 3: Enter the raw A/D reading at maximum elevation

@ Maximum Elevation

A/D Reading `255`

Step 4: Enter the actual maximum antenna elevation

Elevation `180`

Azimuth

Raw A/D Reading `23` (0-255)

Step 5: Enter the raw A/D reading at full counterclockwise

@ Full Counterclockwise

A/D Reading `0`

Step 6: Enter the actual counterclockwise antenna azimuth

Azimuth `180`

Step 7: Enter the raw A/D reading at full clockwise

@ Full Clockwise

A/D Reading `255`

Step 8: Enter the actual clockwise antenna azimuth

Azimuth `180`

Interface / General / Calibration / Advanced

✓ OK   ✗ Cancel   ? Help

Step 9: Click OK to save & exit

Calibration page of Setup/Antenna rotator notebook is used for calibration of your rotator. Follow the steps outlined above for simple and smooth calibration.

Calibration Page

This page consists of two similar panels. They will be described together for the sake of simplicity.

Almost all antenna-interfaces determine the antenna's position by sensing a voltage across a potentiometer. The potentiometer is coupled to the antenna boom (either azimuth or elevation) and as the boom turns, the potentiometer's resistance changes. Antenna-interfaces convert the analog voltage to a digital signals (hence they are called A/D converters). Most commonly-available interfaces are "8-bit" devices[*], meaning that the voltage, representing position, is converted into numbers ranging between 0-255. Note: the smallest detectable change in position is $360°/255 \approx 1.4°$.

In order for Nova for Windows to determine the antenna's true position, it must know how to convert between the 0-255 numbers and degrees; this is the purpose of calibration. You must tell NfW the relationship between the Raw A/D readings reported from the interface to actual antenna headings. This is done by using the antenna rotator's control box to move the antenna to various positions and entering the raw A/D readings in appropriate boxes on the Calibration page.

Calibrating the Yaesu G-5400 series rotator

- Using the rotator's control box, turn the antenna fully counterclockwise and reduce elevation to the horizon.
- Note the raw A/D reading for Azimuth and elevation and enter them in the appropriate boxes (see above).
- Enter the *actual* antenna azimuth (180°) and elevation (0°) in the boxes.
- Turn the antennas to fully clockwise in azimuth. If your antennas can physically manage flip mode (upside down) then turn them to that orientation, otherwise elevate them to vertical.
- Enter the raw A/D readings in the appropriate boxes.
- Enter the *actual* azimuth (180°) and elevation (90° or 180°) in the boxes.

---

[*] The RIF-PC is a 10-bit device.

Advanced page

Azimuth dead band and elevation dead band: these values represent the number of degrees away from the desired target position that the antenna is permitted to point before the rotators are commanded to move and correct. In other words, this is the "error" that your system can tolerate in antenna pointing. For example, if the satellite is located at Azimuth 90° and elevation 45°, but the antennas is pointed at 92° and 43°, the antennas will not turn with a dead band setting of 2° but they would turn if the dead band had been set to 3°. The dead band should be set to values that are small enough to permit full-signal tracking but large enough to avoid "hunting." If the antennas rock back and forth as if they are trying to find the satellite, then the dead band values should be increased. Most antennas have 3-dB beamwidths of 15-30° so a deadband of 3-5° is acceptable.

A/D smoothing factor represents the number of individual readings that are averaged for each displayed value. For example, if the smoothing factor is set to 5 then 5 readings are averaged for each displayed value. This number should be set to the *smallest* value that gives smooth readings. A/D smoothing values that are too large will slow Nova's performance considerably.

The **Tracking thread priority** selection permits you to balance the time allocated to AutoTracking against CPU usage. When set to a high priority value, AutoTracking will operate more smoothly but will also tend to preempt other CPU activities and slow other applications. Tracking thread priority should be set to the lowest value that provides satisfactory AutoTracking performance.

Set dead bands to the largest values that give satisfactory AutoTracking

Time-Out timer can protect rotators from burning out against their stops

Set Tracking thread priority to the smallest value that provides adequate AutoTracking

Set Smoothing Factor to the **smallest** number that gives smooth position readings

Reset entries to factory defaults
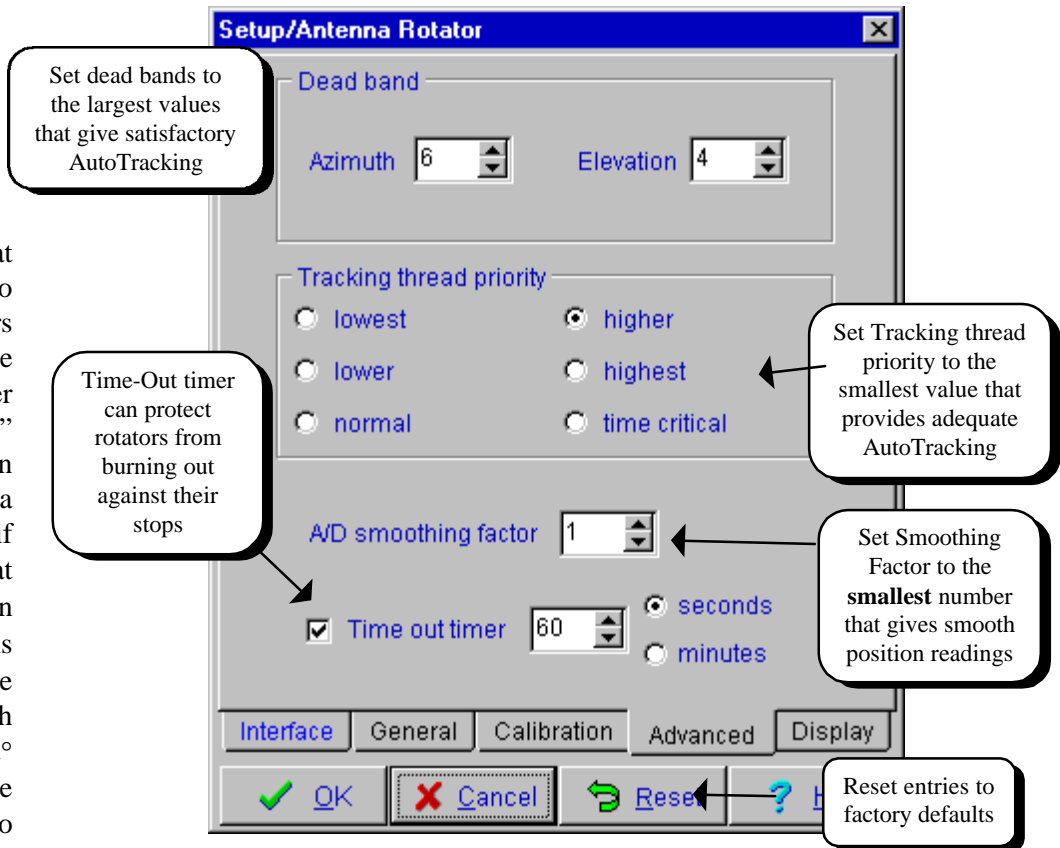
Advanced page of Setup/Antenna rotator. The 16-bit version of NfW does not include the "Tracking thread priority" box.

Views/Configure Current View

One of Nova for Windows' main strengths is its ability to independently configure each View. A View is a single "window" which may include a map, tabular text tracking data, or both. Every View is entirely independent from the others, no matter how many Views are open simultaneously. Views may have different satellites, observers, maps, and even timekeeping.

Tip: Enter the *Individual View Configuration* screen by:

- Right-clicking the mouse on the View that you wish to configure, causing the pop-up menu to appear;
- *or* selecting Views/**Configure Current View** from the Main Menu;
- or pressing the 🔳 *Configure View* button on the ToolBar.

The **Individual View Configuration** screen is shown below. It is divided into three main regions: **Satellite** selection on the left, **Observer** selection on the right, and the View's **current configuration** in the middle.

You may select satellites from the Satellites list [1]. Drag satellite names from this list to the Current Configuration, Satellites list box [2]. Satellites may be added, removed, or rearranged within the Current Configuration Satellites list; their order in the list determines their order of appearance in the tabular text display in the View. The first satellite in the list will be the left-most satellite in the tabular text display.

The Current Configuration, Observers list [3] displays the observer(s) for which satellite position information will be calculated. A "short list" of
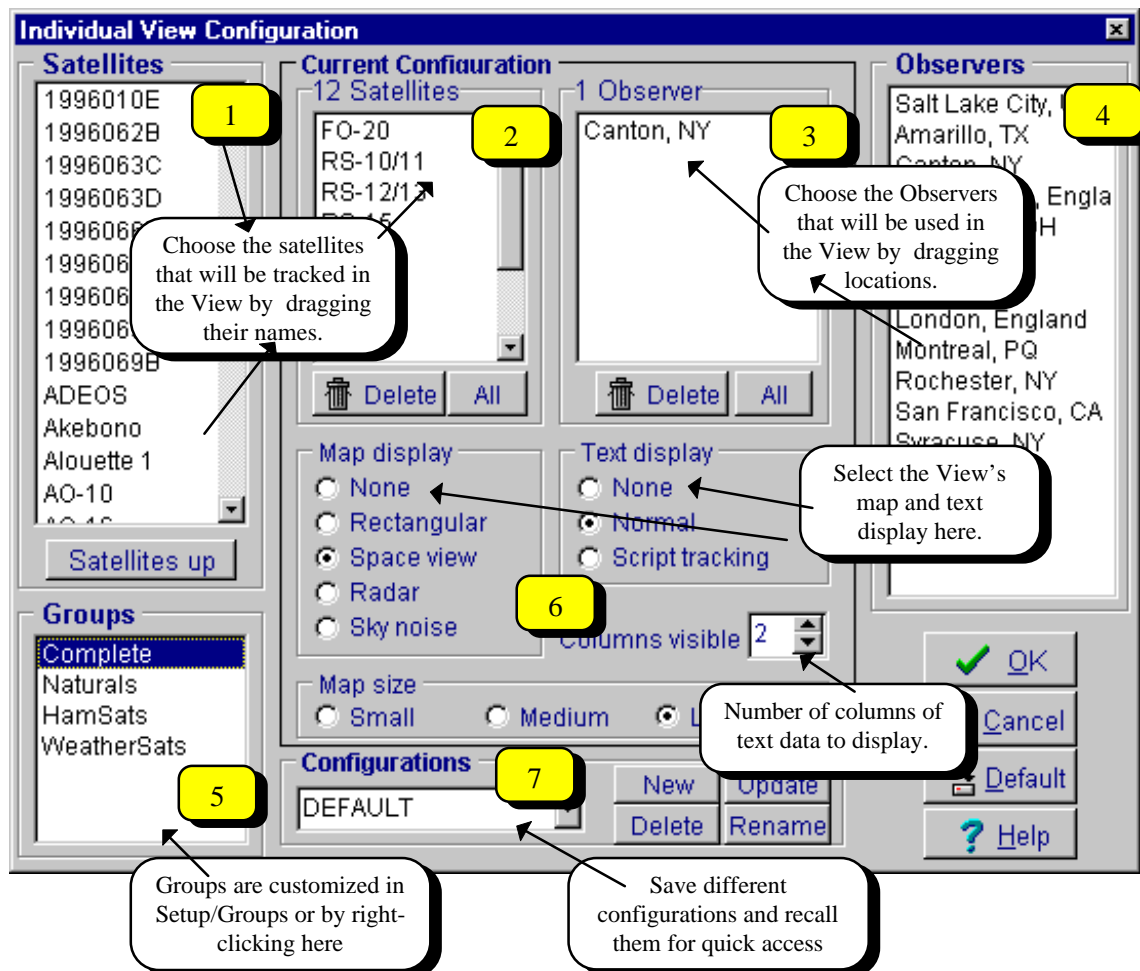
*The **Individual View Configuration** screen is the main focus for making each View appear the way you want it to. This screen is the place to select the satellites and observers that the View will track, as well as the basic maps and text that will be displayed.*

observers is provided for quick access [4]. You may select observers from this list and drag them to the Current Configuration region.

What controls which satellites appear in the Satellite List? The satellites included in the selected Group [5] are displayed in the Satellites list. Clicking on different groups changes the list of satellites displayed. Two groups have special status: the "Complete" group includes every satellite in Nova's database and the "Naturals" group includes the Sun, Moon, planets, celestial noise sources, and cold sky regions. The remaining groups may be modified by the user in the Setup/Groups selection from the Main Menu or by right-clicking here on the Groups Box.

What controls which observers appear in the Observers list? Nova for Windows includes several large databases of locations, including a list of 2,000 cities. These lists are too large for easy access so you create a "short list" for use in day-to-day Observer selection. This short list is displayed in the Observers list box. It may be as long as you wish. You may modify the Observers list by using the Setup/Observers selection from the Main Menu or by right-clicking on the Observers box here in the Individual View Configuration screen.

The general appearance of the View is controlled by the **Map Display** and **Text Display** boxes [6].

Select what type of map you wish (or no map for an all-text display) on the left and what sort of text display on the right. Each View *must* contain a map or text (or both).

How does one configure maps? Maps may be configured by right-clicking within the Maps box [6] or by pressing the Maps Configuration button on the ToolBar. This will display a multi-page screen that permits control of many aspects of appearance for all of Nova's maps. This screen is described in detail below (p. 38).

The number of columns of text (1-12 columns) is controlled by the Columns Visible entry; large maps may not fit on the screen with several columns of text. If more satellites are being tracked than can fit in the number of columns that have been entered, a scroll bar is presented in the view to slide the display horizontally. The Script Tracking selection is discussed in detail below (page 27).

Advanced users may find that they wish to store and recall certain **configurations**. For example, configurations (satellites, maps, etc.) may be different between Weather satellites and amateur radio communications satellites. You may record View configurations by using the Configurations drop-down box [7]. After establishing an acceptable configuration, press the [New] button. You will be queried for a name for the configuration that will later be presented in the drop-down box. Other buttons permit you to **update** an existing configuration, **delete** a configuration, or **rename** it. All stored configurations are available for use in other Views.

Views/View Style

Nova for Windows can operate in one of two modes:

Free-Floating Views: all Views are free to be located anywhere on the windows desktop. They may overlap other Windows applications and other applications can "show through" between NfW's Views. With free-floating Views, the NfW Main menu is unobtrusive (but it can also be lost under other windows).

Contained Views: All NfW Views are contained inside the main NfW screen. If a View is moved beyond the edge of the main Nova screen, it is trimmed. Space between Views is solid desktop color. With contained Views, the Main Menu is always at the top and easy to find. Furthermore, new Views are launched by double-clicking on the NfW screen.

The screenshot shows a "Configuration" dialog with the following annotations:

- "Normal" footprint is centered on the **satellite** (pointing to Normal footprint)
- Show paths of the satellite over the Earth's surface (pointing to Ground tracks)
- "NASA" footprint is centered on the **observer** (pointing to "NASA" footprint)
- Elevation contours can be added to normal and NASA footprints (pointing to Show elev. contours)
- Set the middle of the rectangular map (pointing to AutoCenter map)

Dialog controls include: Map area (World, N. America, E. Asia, S. America, Oceania); Ground tracks (Show ground tracks, Show semi-tracks, Tracks of all satellites, Ground track color); Footprints (No footprint, Normal footprint, "NASA" footprint, Mutual footprint); Fill (First, Visible, All, Clicked); Use elev. mask, Show elev. contours, Footprint only when visible; General (Show political boundaries, Show lat/lon grid, Show Observers, World map central longitude, AutoCenter map, Highlight satellite names); buttons OK, Cancel, Reset, Help; tabs Rectangular, Radar, Sky Noise, Horizon table.

Map Configuration

Nova for Windows includes over 150 maps of various projections, sizes, and areas of coverage. Furthermore, you have almost complete control of the information displayed in the maps so that they always display the data that you need without clutter.

Map Configuration is available in five pages in the same "notebook;" click on the bottom tabs to change pages. The Rectangular and View from Space maps share several options and their setup screens appear similar.

Tip: You may access the Map Configuration "notebook" by several routes:

- Right-mouse click on a View and select Map Style, then Configure Maps;
- Click on the 🔲 *Configure Maps* button on the ToolBar
- Open the Individual View Configuration screen and right-click on the Maps box (remember that right-clicking on things lets you configure them)

Rectangular Map

The Rectangular map is familiar to most people. It shows the entire Earth "unrolled" so that it is visible at a glance. Nova's Rectangular map is based on a modified Miller projection that shows the major continents with relatively little distortion; the north and south poles cannot be shown adequately on any rectangular map.

The *Map area* box permits selection of the map that will be displayed. *World* means that the map will display the entire world whereas the various continent names allow zoom-in views of each continent. The individual continent maps provide resolution of approximately 10 km/pixel at maximum size.

Ground display controls dynamic features added to the base map. The "normal" *footprint* of a satellite represents the area of visibility of a satellite; that is, the area of the Earth that is visible from the satellite at any particular moment. The normal footprint is drawn around the satellite's sub-satellite point (the point on the Earth directly underneath the satellite). "NASA" style footprint, on the other hand, is drawn around the observer. This is the format used by NASA when showing the Shuttle in orbit. Each

ground station has a "fence" drawn around it that represents its horizon for the Shuttle. As the spacecraft crosses the "fence," it simultaneously rises above the horizon for the observer. The radius of the NASA-style footprint changes with the height of a satellite above the ground.

Filling footprints refers to the light shading that NfW can add to the footprint to make it more easily visible. NfW provides the option of displaying filled footprints for only the first satellite on the View's satellite list, for all satellites in the list, or none of them.

Elevation contours may optionally be drawn within a footprint. Elevation contours are concentric lines that show elevation angles of the satellite above the horizon. Pressing the ▦ *elevation contours* button displays a set-up screen for selecting parameters for the contours to be drawn.

Ground tracks are lines that trace the movement of the satellite over the Earth's surface. Ground tracks are useful ways to visualize future positions of the satellite. NfW permits you to display ground tracks for only the first satellite in the View's satellite list, for all satellites, or none [enter 0 (zero) in the spin box]. In addition, the spin box allows setting the number of orbits' worth of ground track to be drawn.

Semi-Tracks are short segments of ground track that show the general direction of the satellite's movement without cluttering up the entire map. Set the number of minutes of satellite movement to be displayed in the spin box.

NfW permits setting the ***central longitude*** of the Rectangular world map. You can center the map at any longitude by entering the value in the spin box. Alternatively, you can let NfW automatically center the map over the first observer in the View's Observers list by checking the ***Auto-Center map*** box.
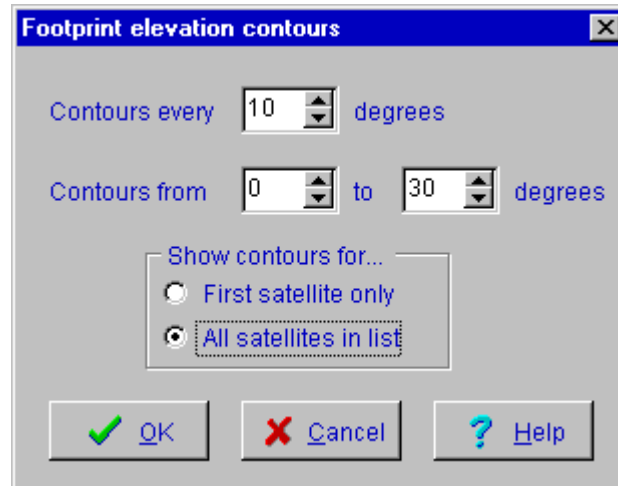
Example of a footprint drawn with elevation contours. The outer ring is 0°; contours are every 10° from 0° to 30°.

View From Space Map

The View from Space map presents the Earth as seen from outer space in a three-dimensional perspective. It is based on the Orthographic map projection.

Options for the View from Space are displayed in the **Map Configuration** screen (next page). The map may be centered over any of the major continents by selecting them in the **Map Area** box. The Dynamic selection causes NfW to change the center of the map automatically, in accordance with the movement of the first satellite in the View's satellite list. As the satellite moves around the Earth, the viewer's perspective changes automatically.

Normal footprint is a circular area drawn on the map and centered on the satellite's sub-satellite point. This footprint moves with the satellite and represents th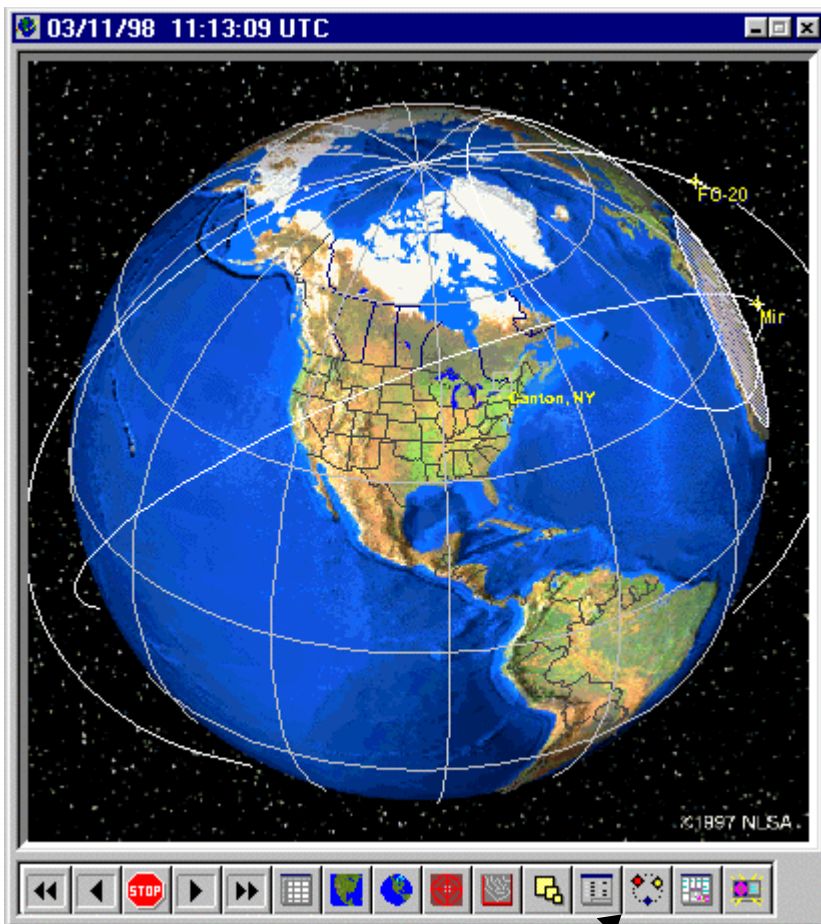e area of the Earth that the satellite can "see." High-altitude satellites have large footprints whereas low altitude satellites have small ones.

NASA footprint is centered on the first observer and represents the horizon for the first satellite on the list. In other words, when the sub-satellite point (the spot on the Earth immediately underneath the satellite in space) of first satellite on the list crosses the NASA footprint perimeter, the satellite has just risen above the observer's horizon. This is the display used by NASA for each of its tracking stations. If the observer's horizon is obstructed in some directions and the Horizon table (see below) has been filled out, it will be useful to check the **Use horizon table** box so that the NASA footprint portrays the actual horizon of the observer.

Fill first sat's footprint and **Fill additional footprints** control whether the footprints are lightly colored to make them more easily visible. **Number of ground tracks** tells NfW how many orbits to plot as lines on the Earth's surface. The lines represent the paths of the sub-satellite point; a ground track helps to show where a satellite will be traveling in the future. Set this value to 0 (zero) to turn ground tracks off.

> **Tip:** You can also change the View from Space's center continent by left-clicking on the map itself, on the desired continent

*Configure the **View from Space** map by clicking on **the Map Configuration** toolbar button*
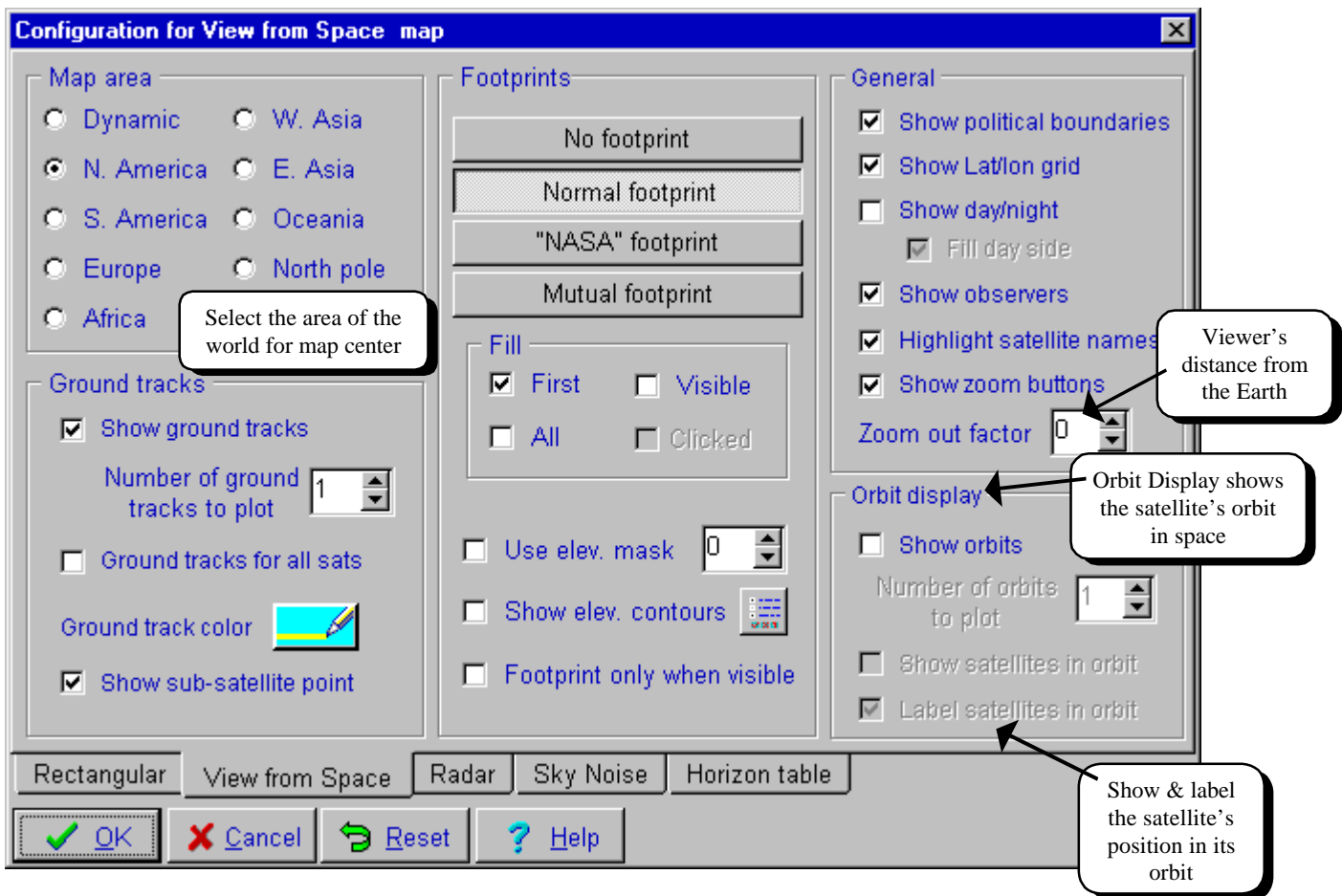
*Map Configuration notebook's **View from Space** page.*

The **Orbit Display** box contains settings that control plots of satellite orbits in space (as opposed to on-the-ground). You can set the **number of orbits** of each satellite to show by entering a number in the spin box. In order to show the orbits of some satellites, it is necessary to "step back" from the earth to get a useful perspective. The **Zoom level** spin box controls the viewer's apparent distance from the Earth. Large zoom levels make the Earth appear smaller and permit plotting of high-altitude satellite orbits. Finally, you may select whether to **show** the satellite's position in its orbit as well as whether to **label** it.

Radar Map

NfW's **Radar map** is an innovative means to display satellite positions relative to an observer. The Radar Map is centered on the first observer in the View's observer list. North is at the top of the map and concentric circles indicate elevation above the horizon. The outer edge of the map is the observer's horizon. The center of the Radar map is overhead.
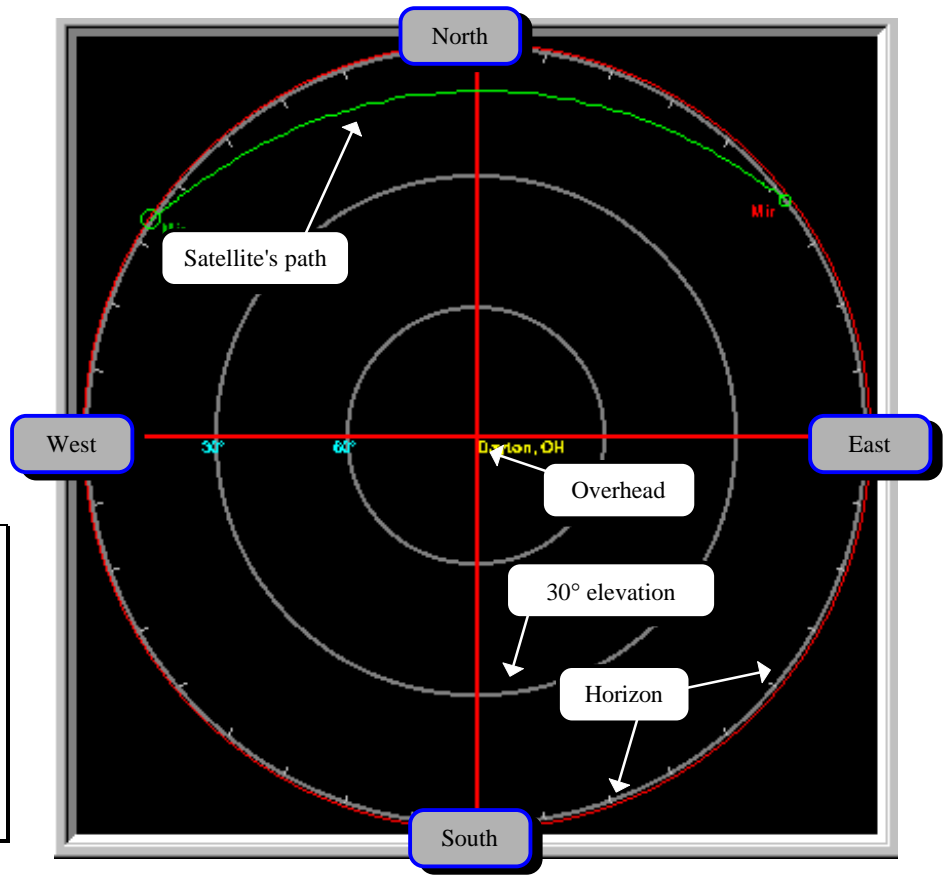
When AutoTracking is enabled, the Radar Map antenna circle should remain approximately centered on the moving satellite marker throughout each pass. This lets you visually observe your tracking system's performance

North

West

East

South

Satellite's path

Overhead

30° elevation

Horizon

Configuration for Radar map

Number of satellite passes to plot on the Radar Map..

Satellite paths
☑ Show satellite paths
Number of paths to plot [1]
☑ Show paths of all satellites
☐ Show when optically visible

Check here to show passes of all satellites rather than only the first satellite in the list

☑ Show antenna position
Approx antenna beamwidth [30] degrees

Use the Horizon Table to outline areas of horizon obstruction from Observer's location.

☐ Use horizon table
☑ Show location label
☐ Enable Sat-ID
☑ Show cursor az/el

☐ Shaded background
☐ Flip East-West
☑ Label N-S-E-W

Also show ...
☑ Stars
☑ Show star names
Minimum magnitude [5]
☐ Constellations
☐ Planets
☐ Moon
☐ Sun

Approximate antenna 3-dB beamwidth for antenna position display.

Rectangular | View from Space | Radar | Sky Noise | Horizon table

✔ OK ✗ Cancel ? Help

The **Radar map page** of the map configuration screen is shown on the previous page. The **number of passes to plot** affects how many paths to display across the Radar map. It is often useful to plot the next pass or two to visualize where in your sky the satellite will be, how high it will ultimately rise, etc. Set this spin box to 0 (zero) to turn off pass plotting. By selecting **Show passes of all satellites** you can control whether NfW plots passes of only the first satellite on the View's satellite list or all satellites in the list. If the observer's horizon is obstructed in some directions and the Horizon table (see below) has been filled out, you may check the **Use horizon table** box so that the radar map perimeter portrays the actual horizon of the observer

The Radar map can plot the direction in which your antennas are pointed if an antenna interface is installed. By selecting **Show antenna position**, a circle is displayed on the radar screen corresponding to the direction of the antenna. The diameter of the circle is set by the **Approx. antenna beamwidth** spin box.

If *Enable Sat-ID* is checked, mouse-clicking on the Radar map will show a pop-up status box of the nearest satellite. If Sat-ID is not enabled, then clicking on the Radar screen will command the rotators to move to that azimuth and elevation.

Sky Noise

The sky is not entirely quiet at VHF/UHF frequencies. Some regions generate noise that can mask weak signals. The Sky Noise map is useful for determining when the satellite will be located in front of noisy areas of sky.

The Sky Noise maps are drawn in a format that may not be familiar to some users. The vertical axis is Declination, which is measured above (north) and below (south) of the equatorial plane. The equatorial plane is a projection of the Earth's equator out into space. The horizontal axis of the Sky Temperature map is presented in Right Ascension. R.A. is measured in hours (1 hour = 15°) with 0 hours being along a north-south line at Greenwich, England. Lines on the Sky Temperature map are "contours" generally similar to contours on a topographic map. Each contour connects points of equal noise temperature.

The Sky Noise map configuration page permits setting various options on the Sky Noise map. **Map Frequency** sets which map is drawn on the screen. Maps have been prepared by the IEEE for 50 MHz, 136 MHz, and 400 MHz. The 136 and 400 MHz maps correspond to the amateur 144 and 432 MHz bands.

Show Horizon plots a curve on the map that represents the current horizon at the AutoTracking Observer's location. **Show satellite path** displays a curve showing the path of the satellite against the sky. **Show Sun** plots the sun's position on the map and **Show temperature labels** displays numbers representing equivalent noise temperature of the map's contours.

Horizon Table

Horizon Table is a means of modeling the observer's horizon to account for obstructions such as mountains, buildings, or trees. The full-circle horizon is divided into 20° slices in the Horizon table configuration page. For each slice, enter the actual horizon elevation as seen from the antenna's point of view. For example, if mountains obstruct the horizon from 80°-180°, then their general profile can be entered in the 80°-180° slices (see example). Where the horizon is flat, enter 0°. It is also possible to enter negative values if necessary.

Horizon table modeling is used in display of NASA-style footprints and in the outer perimeter of the Radar map. The horizon table is not included in

AOS/LOS calculations, which are based on a 0° horizon assumption.

Map Configuration

Horizon @ 0-20°	5
Horizon @ 20-40°	0
Horizon @ 40-60°	5
Horizon @ 60-80°	0
Horizon @ 80-100°	5
Horizon @ 100-120°	8
Horizon @ 120-140°	13
Horizon @ 140-160°	8
Horizon @ 160-180°	4
Horizon @ 180-200°	0
Horizon @ 200-220°	0
Horizon @ 220-240°	0
Horizon @ 240-260°	0
Horizon @ 260-280°	0

Horizon table for AutoTracking location: Canton, NY

If the AutoTracking Observer's horizon is blocked in some directions, edit these values to show the horizon at the specified azimuth. For example, this entry shows that the horizon from 120°-140° azimuth is 13°.

*The **Horizon table** permits visualization of obstructions to the AutoTracking observer's horizon*
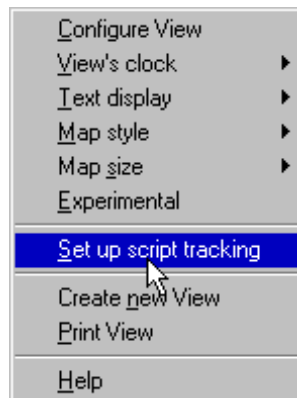
Satellite Script Tracking

Nova for Windows includes a powerful tool for managing automated tracking of multiple satellites.

The Satellite Script is a time-sorted list of passes for all the satellites in a View. When Script Tracking is enabled, NfW will automatically track multiple passes of multiples satellites for an indefinite period of time.

Minimum Pass Duration refers to the duration of a pass. If the pass's duration is less that the value set in this entry then the pass will not be included in the Script. Clicking on the **Default** button before exiting the screen will set these rules as defaults to be used in all subsequent Script operations.

Each View maintains its own Script. You may preview and edit the entries in the Script by using the Script Editor. Access the Script Editor by right-clicking the mouse on a View and selecting **Set up Script Tracking** from the pop-up menu.

Configure View
View's clock ▶
Text display ▶
Map style ▶
Map size ▶
Experimental
Set up script tracking
Create new View
Print View
Help

The Satellite Script editor consists of two pages: **Text** and **Graphics**. The Text display lists *every* pass of *every* satellite in the View's list in chronological order.

In order to use Script Tracking, passes must be *selected* from this complete list. If there are more than two or three satellites in the list, it is

Set up Satellite Script by right-clicking on a View to show this pop-up menu

likely that some of them will overlap in time with others. Therefore the passes that you wish to include in Script Tracking must be chosen, a process called "selecting."

You may select passes manually or you may let NfW do the job automatically by using the **AutoSelect** button. To manually select passes in the text screen, simply click on them with the mouse. In the Graphics screen, click above the pass line (this will cause an arc to appear over the pass line, indicating that the pass is selected).

Configure Script Tracking

Start Date/Duration

1997

3 Month

31

2 Duration (days)

☑ Default to current

Script Rules

☐ Favor higher priority satellites

☐ Only Ascending passes

☐ Only Descending passes

Minimum elevation attained (degrees) [0]

Minimum pass duration (minutes) [0]

✓ OK   ✗ Cancel   Default

Callouts:

In situations when two satellites are visible simultaneously, select the one that is higher on the View's satellite list

Select passes that are passing from *south* to *north*

Select passes that are passing from *north* to *south*

Select passes that reach *at least* this elevation

Select passes that last *at least* this long

Set these rules as defaults for all Scripts

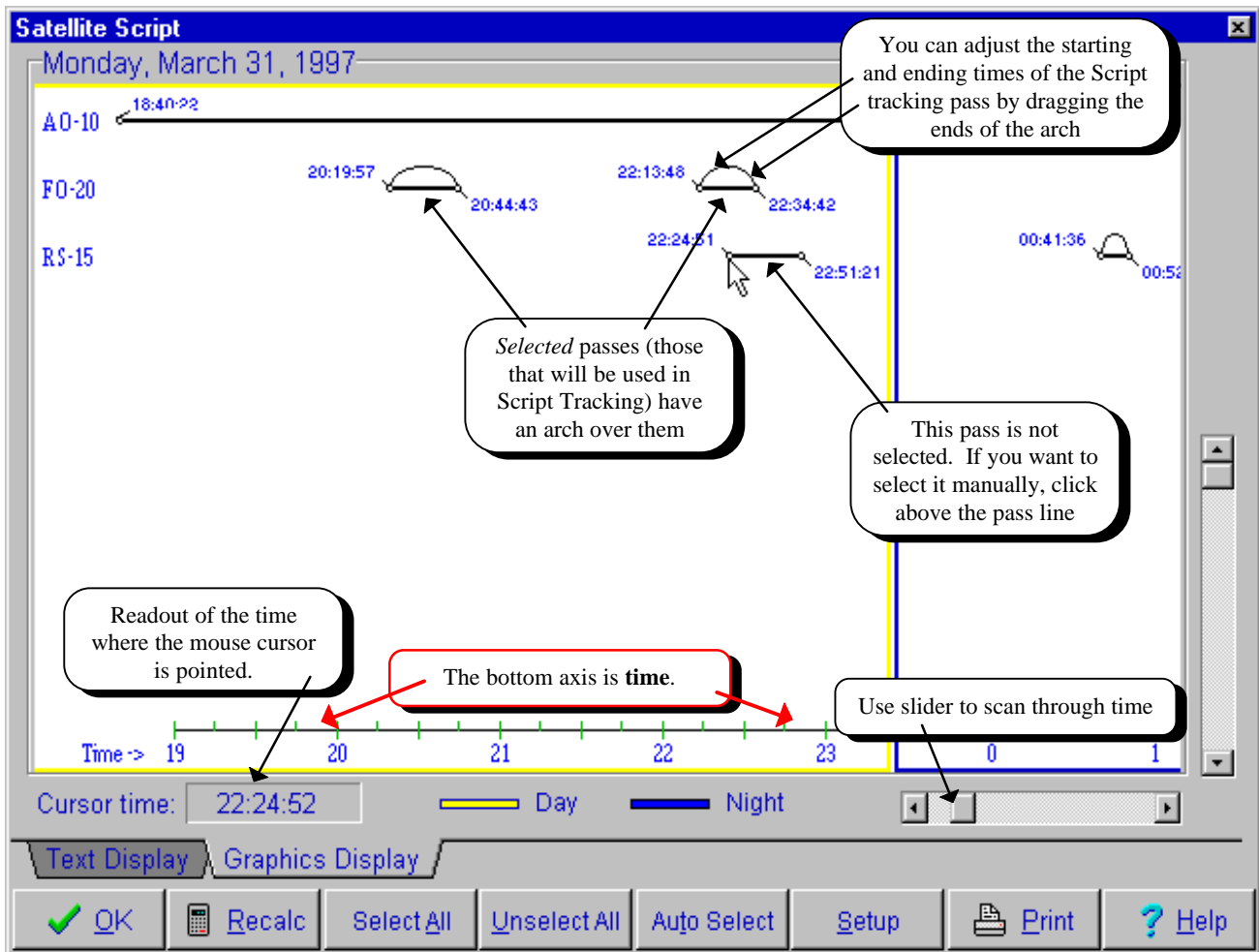*Configure Script Tracking screen sets the rules/limits for use in selecting satellites for Script tracking.*

Satellite Script

Satellite	Date	AOS Time	LOS Time	Duration	Interval Between	AOS Az	Max El	LOS Az
AO-10	3/31/97	12:56:15	14:32:54	01:36:38	11:46:20	271°	30°	135°
RS-15	3/31/97	13:24:10	13:54:05	00:27:50	---------	229°	63°	38°
RS-15	3/31/97	15:40:39	16:08:06	00:27:26	01:46:33	274°	30°	53°
FO-20	3/31/97	16:47:45	17:01:58	00:14:13	00:39:38	75°	8°	358°
RS-15	3/31/97	17:...	...	00:27:01	00:55:50	308°	31°	89°
FO-20	3/31/97	18:...	...	00:22:10	00:06:36	125°	33°	352°
AO-10	3/31/97	18:...	...	05:09:17	---------	139°	12°	100°
FO-20	3/31/97	20:...	...	00:04:06	---------	169°	75°	345°
FO-20	3/31/97	22:1...	...	00:20:54	01:29:04	217°	18°	334°
RS-15	3/31/97	22:24:51	22:51:21	00:16:39	---------	322°	38°	183°
RS-15	4/1/97	00:41:36	00:52:05	00:10:29	01:50:14	298°	2°	252°
FO-20	4/1/97	08:06:17	08:23:31	00:17:14	07:14:12	21°	29°	161°
RS-15	4/1/97	...38:58	08:47:32	00:08:34	00:15:26	102°	2°	66°
FO-20	4/1/97	...56:47	10:...	...:15	10°	50°	216°	
RS-15	4/1/97	...37:45	11:...	...:44	174°	35°	39°	
FO-20	4/1/97	11:48:09	12:...	...:56	3°	11°	271°	
AO-10	4/1/97	12:11:44	13:...	...:54	271°	33°	131°	
RS-15	4/1/97	15:03:37	15:...	...:37	265°	33°	49°	
FO-20	4/1/97	17:05:23	17:21:19	00:15:55	01:33:48	85°	11°	357°
RS-15	4/1/97	17:21:07	17:47:54	00:26:34	---------	303°	28°	80°
FO-20	4/1/97	18:50:01	19:12:57	00:22:55	01:02:07	133°	41°	351°
AO-10	4/1/97	19:22:22	23:09:17	03:46:55	00:09:24	136°	7°	105°

Passes in script list: 33   Passes chosen from script list: 24

Text Display / Graphics Display

✓ OK   Recalc   Select All   Unselect All   Auto Select   Setup   Print   Help

Callouts: Blue-highlighted passes have been *selected* for use in Script tracking.' Initial listing shows all passes of all satellites in the View' Select passes individually by mouse-clicking on them, or let NfW select automatically

*The **Text** page of the Satellite Script notebook shows all passes of all satellites in the View's satellite list. You may select passes by mouse-clicking on them or by letting NfW select them automatically using the rules set in the Configure Script Tracking screen (above).*

*Nova for Windows' **graphics display** of Satellite Script pass data presents a clear summary of multiple passes of several satellites. Lines represent passes; arcs over lines show "selected" passes.*

AutoSelect evaluates all the passes in the list according to the rules set forth in the **Configure Script Tracking** screen. In the Configure Script Tracking screen, you can set the beginning and ending times for Script calculations as well as set **Script Rules**. These rules govern how NfW evaluates passes to see whether they are selected in the Satellite Script. Each pass must meet the criteria set in the Script Rules for it to be AutoSelected.

Default to Current tells NfW to always use the current date/time as the starting point for Script calculations. If this box is unchecked then Script calculations will begin at the time/date specified in the spin boxes.

Favor Higher Priority Satellites means that if two satellites are above the horizon at the same time (and otherwise meet selection criteria) that the satellite whose name is higher on the View's satellite list will take precedence. If this box is unchecked, then the satellite with the longer remaining pass duration will be selected without consideration of its priority.

Only Ascending Passes means that only satellites that appear above the horizon ("rise") in the south and "set" in the north will be selected**; Only Descending Passes** means that passes must rise in the north and set in the south to be selected. This option is useful for polar-orbiting weather satellites.

Minimum elevation attained refers to the elevation above the observer's horizon that the satellite attains during a pass. In other words, if Minimum Elevation Attained is set to 25° then the satellite must achieve an elevation of *at least* 25° at some time during a pass for that pass to be selected. If the satellite's maximum elevation during a particular pass is only 24° then that pass will not be included as part of the Script.

Utilities/Listing

Nova for Windows includes comprehensive capabilities for producing tabular listings of satellite positions. Listings may be directed to the screen, to a printer, or to a disk file.

Listings are available in four main formats:

- **One Observer** presents information about one satellite as seen from one observer's location. Position data are calculated at step intervals as set in the Setup screen (see below).

- **AOS/LOS** lists only AOS/LOS times for the satellite and *one* observer; this is convenient for assessing many upcoming passes of the satellite on one screen.

- **Two Observers** lists one satellite's position from the points of view of *two* observers simultaneously. This is similar to the One Observer page in that data are presented at a specified time interval (chosen in **Setup**).

- **Two Obs. Mutual Window** is a summary of the mutual windows of the satellite with two observers; these are the times when the satellite is above the horizon at *both* locations simultaneously.

To select a format for listing, click on the notebook tabs across the bottom of the Listing screen. Select a satellite and observer by using the Setup button. Remember to click the ReCalc button to recalculate pass information after making changes in the Setup.

Operating mode (set in Setup/Satellites/Mode Sched)

"Phase" of the satellite... its position in its orbit. Ranges from 0-255 starting at perigee.

Satellite Pass Data

Mir

Time	Azim.	Elev.	Range	Height	Mode	SSPLat	SSPLon	Ph	Squint

Sub-Satellite point latitude & longitude

"Squint" angle (also known as "offpointing"). Based on ALAT & ALON set in Setup/Satellites

```
=============== Mir ================= Tuesday, April 01, 1997 ========
00:57:19  109.0°  + 2.3°  2049.   392.    1    36.7°N  54.0°W 118.7    0°
02:27:19  212.8°  + 4.8°  1813.   39     1    84.7°W 112.    0°
02:32:19  100.5°  +26.5°   814.   3           66.6°W 126    0°
04:02:19  258.7°  + 1.0°  2190.   3           98        0°
04:07:19  340.4°  +41.4°   589.   392.    1    48.1°N   76
04:12:19   58.7°  + 0.9°  2216.   391.    1    51.6°N   48
05:42:19  318.1°  +16.3°  1131.   392.    1    51.0°N   84
05:47:19   60.3°  + 6.4°  1702.   391.    1    50.1°N   55.
07:17:19  308.3°  + 8.6°  1541.   391.    1    51.5°N   91.4°W 149.1    0°
07:22:19   73.5°  +19.9°   991.   390.    1    46.3°N   63.9°W 162.9    0°
08:52:19  295.4°  + 3.3°  1964.   391.    1    49.5°N   98.7°W 156.7    0°
08:57:19  181.9°  +40.0°   594.   389.    1    40.7°N   75.1°W 170.5    0°
10:32:19  229.1°  + 5.5°  1749.   387.    1    33.9°N   88.5°W 178.1    0°
=============== Mir ================= Wednesday, April 02, 1997 ======
01:32:19  152.6°  +16.1°  1127.   392.    1    36.2°N   69.7°W 115.4    0°
01:37:19   73.6°  + 1.8°  2117.                           0.0°W 129.3    0°
03:07:19  253.7°  +28.6°   769.                          °W 123.0    0°
03:12:19   57.3°  + 8.4°  1556.                          °W 136.9    0°
04:42:19  291.0°  + 9.0°  1514.                          °W 130.6    0°
04:47:19   41.0°  +14.4°  1214.           1           84.4°W 144.5    0°
06:17:19  299.4°  + 1.5°  2144.   392.    1    50.9°N  100.9°W 138.2    0°
06:22:19   22.1°  +26.2°   824.   391.    1    50.3°N   71.3°W 153.1    0°
```

Click here to highlight all portions of the pass when the satellite is above Observer's horizon

🗔 Close	📋 ReCalc	🛑 Break	Setup	Visible?	🖨 Print	❓ Help

One Observer / One Obs. AOS/LOS / Two Observers / Two Obs. Mutual windows

One satellite, one observer. Set Satellite, Observer, and time step in Setup

AOS/LOS times only for one satellite

One satellite, two observers. Set Satellite, Observers, and time step in Setup

Summary of mutual windows between two observers

Utilities/Two-Satellite Mutual Visibility

The Two-Satellite Mutual Visibility utility calculates times when two satellites will be in line-of-sight of each other. Two satellites must be mutually visible if they are going to communicate with each other directly and not by means of a ground station.
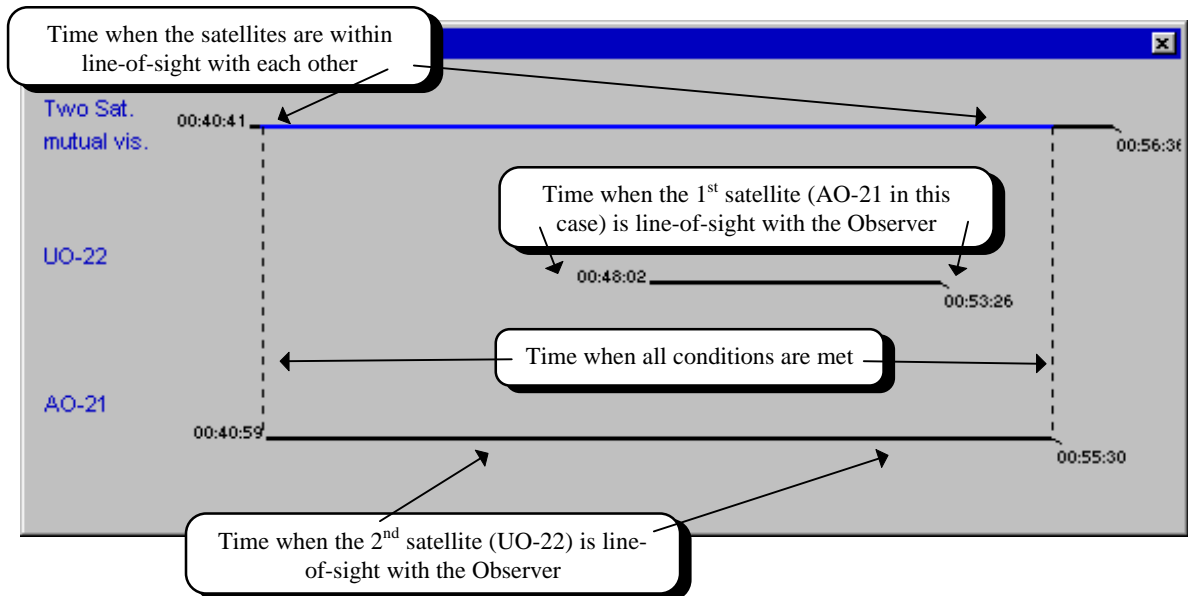

This is the satellite that the Observer can see best during the period of 2-satellite mutual visibility

Period of time when the two satellites can "see" each other

Period of time when the two satellites can "see" each other **and** the first observer can "see" one of the satellites

Same as 1 observer but calculates times when both satellites can "see" each other **and** both observers can "see" one of the satellites.

Time when the satellites are within line-of-sight with each other

Time when the 1st satellite (AO-21 in this case) is line-of-sight with the Observer

Time when all conditions are met

Time when the 2nd satellite (UO-22) is line-of-sight with the Observer

In addition to simple satellite-to-satellite visibility, NfW also calculates the times when one of the satellites will *also* be visible to a ground station. The satellite that is within line-of-sight to the observer is called the access satellite because this is the one which could be accessed from the observer's location while simultaneously being line-of-sight with the other satellite. This situation is necessary if the ground station is going to access one satellite and then relay through the second satellite.

The **1 Observer** page of the Mutual Visibility utility notebook displays data for two satellites and one observer, whereas the 2 Observers page includes a second ground station.

The first step in generating an ephemeris of 2-satellite mutual visibility is to enter the **Setup** screen and select the satellites and observer(s) of interest. When this is finished, click on the ReCalc button to perform the calculations.

The first column of the display shows the date, followed by three columns that show when the two satellites can see each other. The following three columns show the times when the satellites can see each other *and* at least one of them is visible from the observer's location.

The Graphics display shows a diagram of the situation for any pass. First, select a pass by clicking on it. Then press the Graphics button. Three horizontal lines are presented, representing times of visibility of the two satellites. The lower two lines show when the satellites are visible to the observer; the top line shows when the satellites are mutually visible (i.e. visible to each other). The vertical dotted line shows the time period of overlap, when the satellites re visible to each other and one of them is visible to the observer.

Utilities/Eclipses

Nova for Windows' Eclipse Utility permits prediction of time periods during which a satellite will pass into the Earth's shadow. Almost all Earth-orbiting satellites are solar-powered; eclipse periods drain their batteries. If a satellite remains in eclipse for too long, its ability to function may be seriously impaired. In some cases, such as OSCAR-10, onboard battery failure has left the satellite totally dependent on exposure to direct sunlight. The satellite cannot function while it is in eclipse.

The Eclipse utility contains two pages: one that displays Eclipse periods on an orbit-by-orbit basis and another that summarizes entire days at a time.

The **Every Orbit** page shows the starting and ending times of each period of eclipse for the selected satellite. As with the other utilities, you may select the satellite by using the Setup button. **Start**, **End**, and **Duration** are self-explanatory. **Interval between** represents the time between successive eclipse periods. **Daily Summary** combines all eclipses in each 24-hour period and presents a summary. **Duration** is the total number of minutes of eclipse for the day. **Percent** is the portion of the day that the satellite spends in the Earth's shadow. **Longest** is the length of the longest Eclipse of the day. **Sun angle** is the angle between the orbital plane of the satellite and the Sun. **Illumination** is the percent illumination that solar panels receive; it is relevant only if ALAT and ALON information are available and have been entered in Setup/Satellites.

Solar panel illumination if the satellite's ALAT & ALON are known

Eclipse Utility

FO-20

| Date | ------- Eclipse --------- | | | Interval | Sun | |
	Start	End	Duration	Between	Angle	Illumination
4/15/97	00:00:03	00:11:32	00:11:28	--------	-25.5°	0.0%
4/15/97	01:43:20	02:03:50	00:20:29	01:31:47	-25.5°	0.0%
4/15/97	03:35:38	03:56:04	00:2		-25.3°	0.0%
4/15/97	05:27:50	05:48:24	00:			
4/15/97	07:20:08	07:40:38	00:			
4/15/97	09:12:					
4/15/97	11:04:					
4/15/97	12:56:			20:37	01:31:41	
4/15/97	14:49:12	15:09:46	00:20:33	01:31:39	-24.7°	0.0%
4/15/97	16:41:26	17:02:06	00:20:39	01:31:39	-24.7°	0.0%
4/15/97	18:33:44	18:54:20	00:20:35	01:31:37	-24.6°	0.0%
			00:20:37	01:31:40	-24.4°	0.0%
			00:20:37	01:31:36	-24.4°	0.0%
			00:20:33	01:31:39	-24.2°	0.0%
			00:20:39	01:31:39	-24.2°	0.0%
			00:20:35	01:31:37	-24.0°	0.0%
			00:20:44	01:31:35	-24.0°	0.0%
			00:20:39	01:31:33	-23.8°	0.0%
4/16/97	09:31:51	09:52:36	00:20:44	01:31:33	-23.8°	0.0%

Period of eclipse for each orbit

Time between the end of one eclipse and beginning of the next

Angle between the satellite's orbital plane and the Sun

*The **Every Orbit** page of the **Eclipse Utility** summarizes periods of time when the satellite is in the Earth's shadow. This is useful for predicting daily electrical performance.*

Eclipse Utility

FO-20

Date	Duration	Percent	Longest	Sun Angle	Illumination
4/15/97	04:18:21	17.9%	00:20:39	-24.4°	0.0%
4/16/97	04:29:15	18.7%	00:20:46	-23.0°	0.0%
4/17/97	04:31:18	18.8%	00:20:56		0.0%
4/18/97	04:33:03	19.0%	00:21:05		
4/19/97	04:34:51	19.1%	00:21:14		
4/20/9		18.			
4/21/		7.			
4/22/		9.			
4/23/		9.		-12.6°	0.0%
4/24/		9.		-11.0°	0.0%
4/25/		9.6%		-9.3°	0.0%
4/26/		8.4%	00:22:11	-7.6°	0.0%
4/27/97		18.5%	00:22:18	-6.0°	0.0%
4/28/97	04:50:44	20.2%	00:22:26	-4.3°	0.0%
4/29/97	04:52:24	20.3%	00:22:35	-2.5°	0.0%
4/30/97	04:54:05	20.4%	00:22:43	-0.8°	0.0%
5/1/97	04:46:57	19.9%	00:22:50	1.0°	0.0%
5/2/97	04:34:37	19.1%	00:22:56	2.7°	0.0%
5/3/97	04:59:21	20.8%	00:23:05	4.5°	0.0%
5/4/97	05:01:08	20.9%	00:23:14	6.3°	0.0%
5/5/97	05:02:48	21.0%	00:23:22	8.1°	0.0%
5/6/97	05:04:39	21.2%	00:23:31	9.9°	0.0%
5/7/97	04:51:48	20.3%	00:23:39	11.7°	0.0%

Duration of the longest eclipse period during the day.

Eclipses are summarized for the entire day. **Duration** is the sum of all eclipses during the 24 hours UTC.

Percentage of the day that the satellite is in the Earth's shadow.

| Close | ReCalc | Break | Setup | Print | Help |

Every Orbit | **Daily Summary**

*Eclipse Daily summary combines eclipse data for each 24-hour period,
facilitating a longer-term perspective, useful for predicting spacecraft power budgets.*
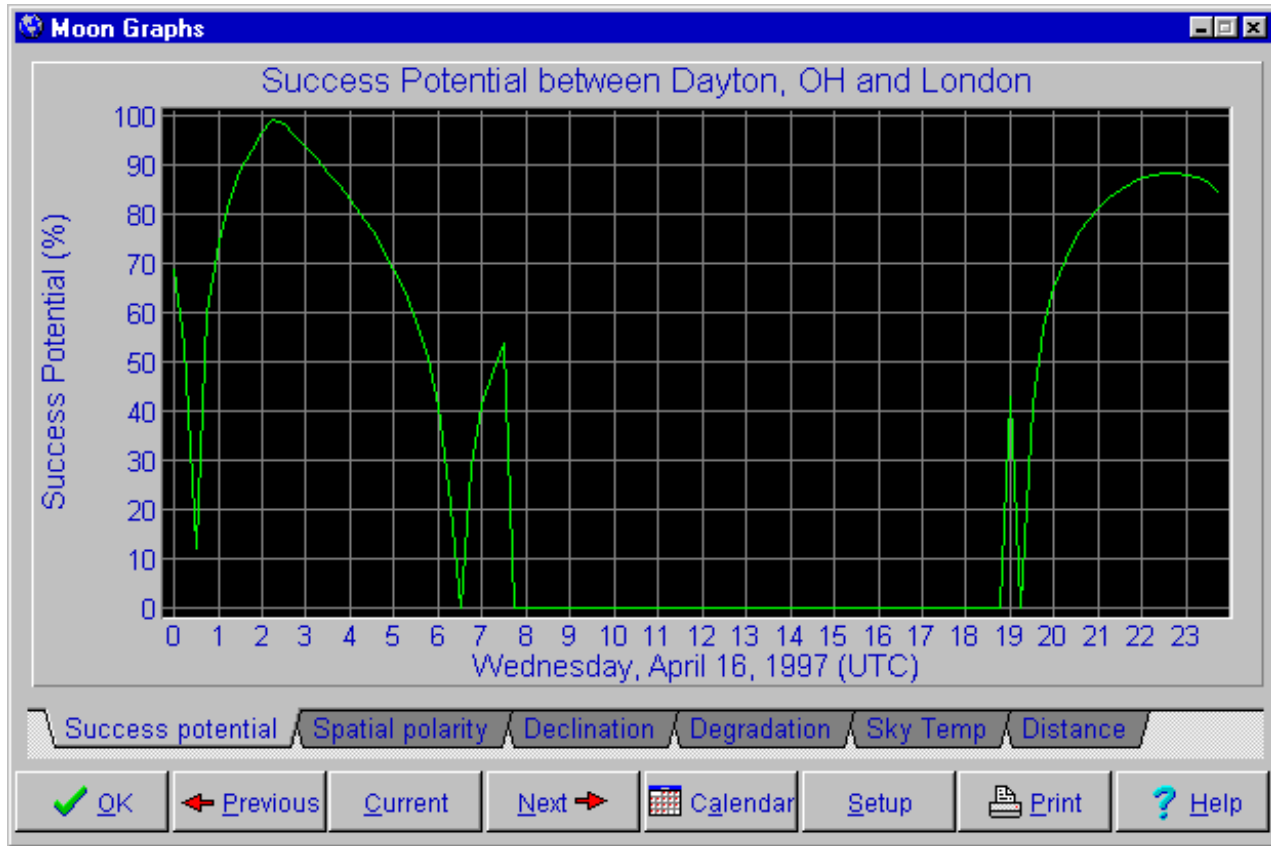
Utilities/Moon Graphs

The Moon Graphs utilities are intended to assist amateur EME (Earth-Moon-Earth) communications. This utility screen has a number of pages that work together.

Success potential (above): This is a daily graph of the estimated success potential of a specific EME link. The two stations are set in the Setup screen. Success potential is based on the assumption that both stations are horizontally (linearly) polarized. Obviously, success potential is zero if the Moon is below the horizon for one or the other station. During times of mutual window, success potential is dependent on the chances that Faraday rotation (which is essentially unpredictable) will be aligned in a manner that will counteract spatial polarity mis-alignment of signals (see below).

Paul Kelly (N1BUG) has shown that Faraday rotation can overcome the effects of spatial polarity offset. As an example, consider two stations that are currently experiencing 90° of spatial polarity offset. This would normally result in extremely high loss via the EME path. However, if there is 45° of Faraday rotation, then a transmitted signal will rotate 45° on the way to the Moon and 45° on the way back, resulting in excellent alignment. NfW's graph calculates spatial polarity offset as well as the range of possible Faraday rotation angles that would be necessary to produce low-loss alignment of EME signals between the two stations. The larger the range of "good" Faraday angles, the better the probability of success. A small range of "good" Faraday angles means that Faraday must be just right, and it seldom is, so that the success potential is lower.

Spatial Polarity: This graph displays the geometric spatial polarity offset between two stations for a 24-hour period. The offset is converted to dB for ease of comparison. Spatial polarity offset results from the fact that two horizontally-polarized antennas are not co-planar if the stations are located far apart from each other. Specifically, Northern-hemisphere stations (JA-NA, NA-EU, for example), when viewed from the Moon, are nearly perpendicular to each other. On the other hand, stations at the same longitude are always co-planar and never suffer much spatial polarity offset. The amount of spatial polarity offset changes as the Moon moves so the value of offset can be graphed each day. If net Faraday rotation is low, as it often is during times of low solar activity, then spatial polarity offset provides a useful guide to signal strengths.

Declination: This graph shows the cyclic changes of the Moon's declination through a month. Declination is the angle between the Earth's equatorial plane (the imaginary plane that passes through the Earth's equator and extends in all directions out into space) and the Moon. This angle varies +/- ~20° each month. Northern-hemisphere stations have longer Moon access, and generally lower sky temperatures, when the Moon is at higher declination.

Degradation : This graph displays the EME path degradation as computed from equations originally developed by Derwin King, W5LUU. Degradation is expressed as dB in comparison to the best-case situation of lunar perigee against quiet sky. In other words, if the Moon is not at perigee and is in a region of sky that emits more noise than "cold sky," then EME signals will be degraded by some amount.

Degradation is dominated by sky noise on 144 - 432 MHz and by distance at higher frequencies. This is because the sky is uniformly rather quiet above 432 MHz. A "spike" in degradation is visible on the graph at times when the Moon is in front of regions of noisy sky; in general, EME operation is difficult at these times.

Sky Temperature is one way of expressing the RF noise emitted by the billions of stars in the sky. Some places in the sky have relatively few close, noisy stars so those regions are considered relatively quiet in the VHF-UHF range. On the other hand, the center of our galaxy is extremely noisy because it is relatively close and contains a huge number of stars. The Sky Temperature graph shows how the contribution of sky noise varies through the month as the Moon moves across the sky. At some times, the Moon is in front of quiet sky and EME operation is favored. At other times, the Moon is in front of noisy sky and EME signals are relatively weaker because they are partly (or completely) obscured by the noise from the rest of the universe.

The **Distance** graph shows how the Earth-Moon distance varies through the month. The Moon's orbit is elliptical, meaning that is sometimes quite a bit closer than at other times. This difference amounts to approximately 2 dB difference in EME signal strength between perigee (closest) and apogee (farthest).

The Moon graphs utility also contains a pop-up calendar. It is useful for viewing the dates of weekends (when most EME activity takes place). You may click on days to move the graph's day quickly.
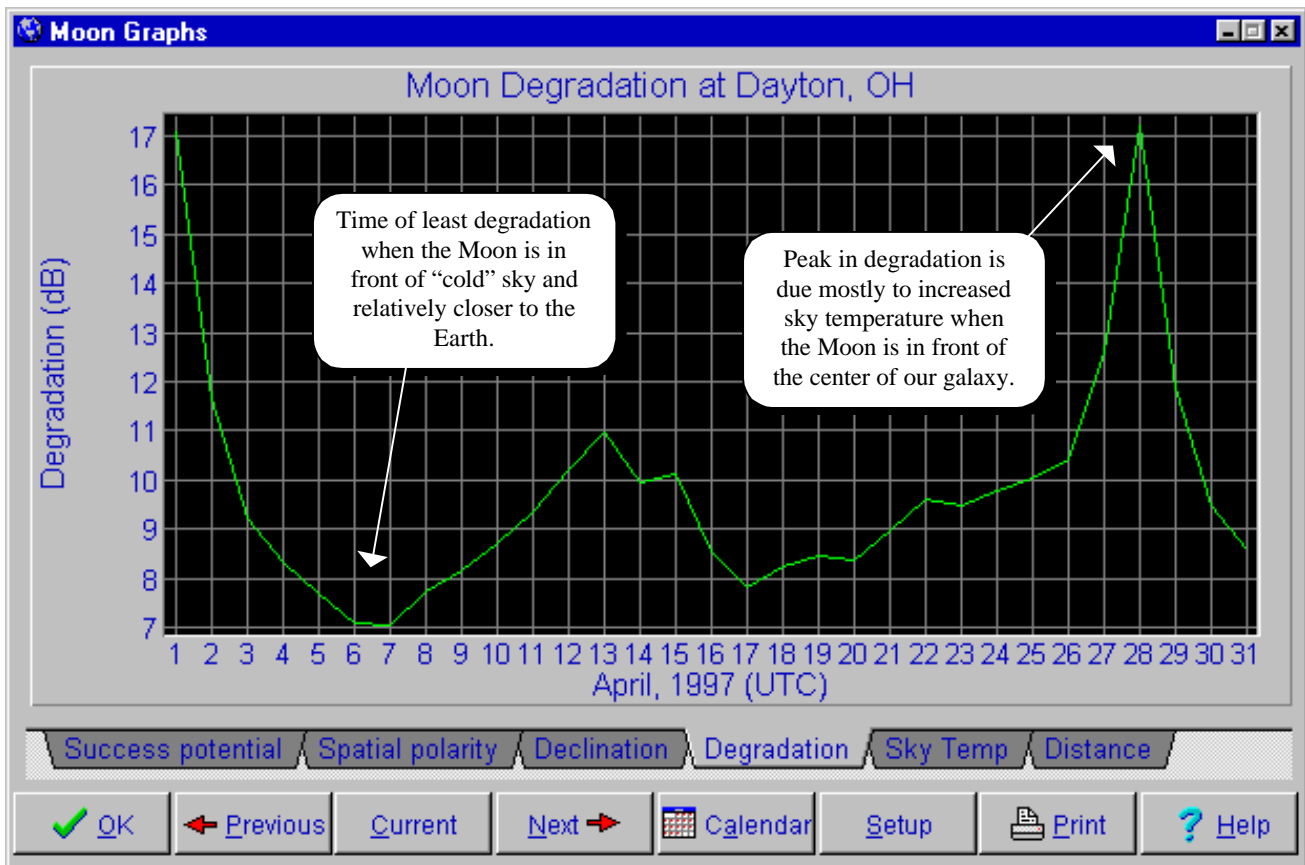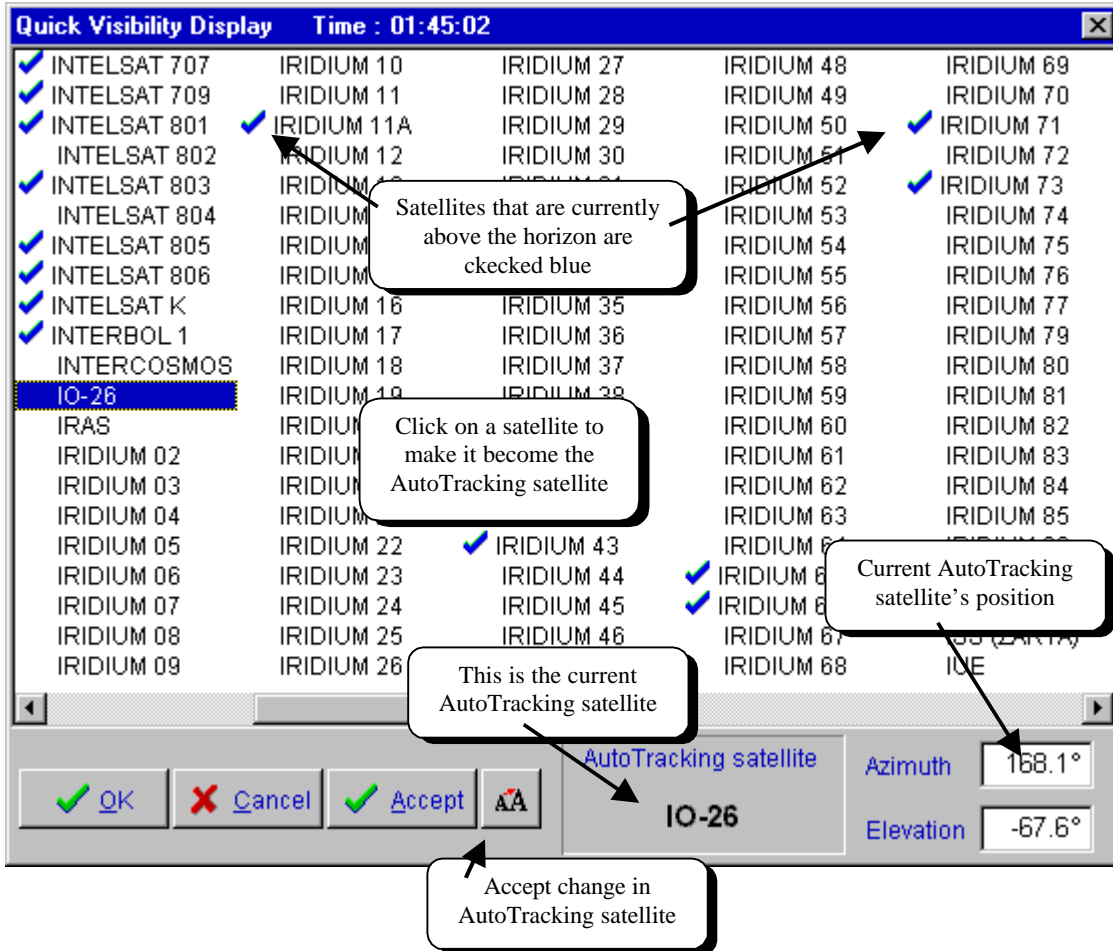
Utilities/Quick Visibility Check

The Quick Visibility Check provides an overview of all the satellites in the main Nova database. Blue check marks adjacent to satellite names indicate that they are currently above the AutoTracking observer's horizon. Visibility is recalculated every five seconds.

Azimuth/elevation data for one satellite are displayed in the lower right corner. You may select a different satellite by mouse-clicking on it. Initially, the selected satellite is the AutoTracking satellite. If you select a different satellite in the Quick Visibility Display, it can become the AutoTracking satellite if you also press the

✔ Accept button.

AutoTracking

Nova for Windows includes full control of azimuth/elevation antennas using one of several commercial control interfaces. When AutoTracking is engaged, antennas will follow the AutoTracking satellite whenever it is above the horizon at the AutoTracking Observer's location.

*Right-clicking on the **AutoTracking Status Box** (next section) displays a **pop-up menu** for configuring AutoTracking.*
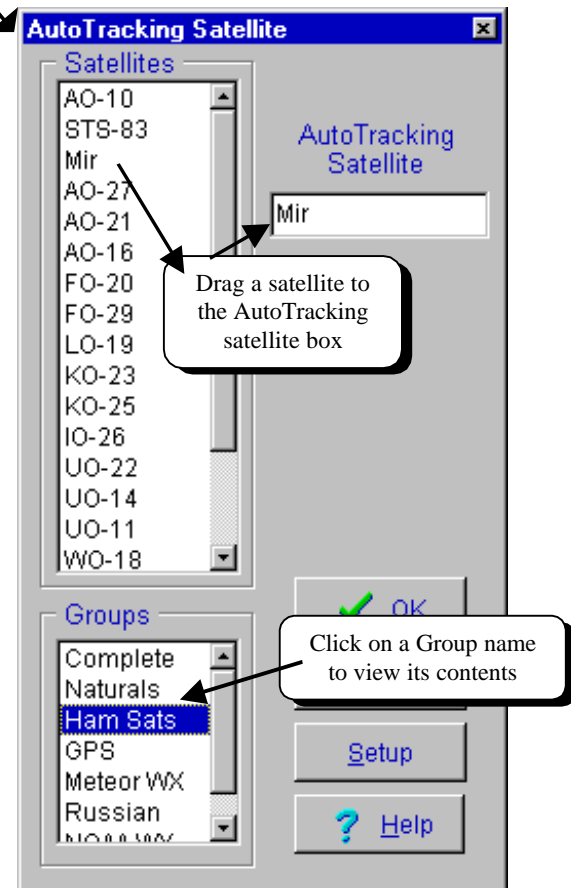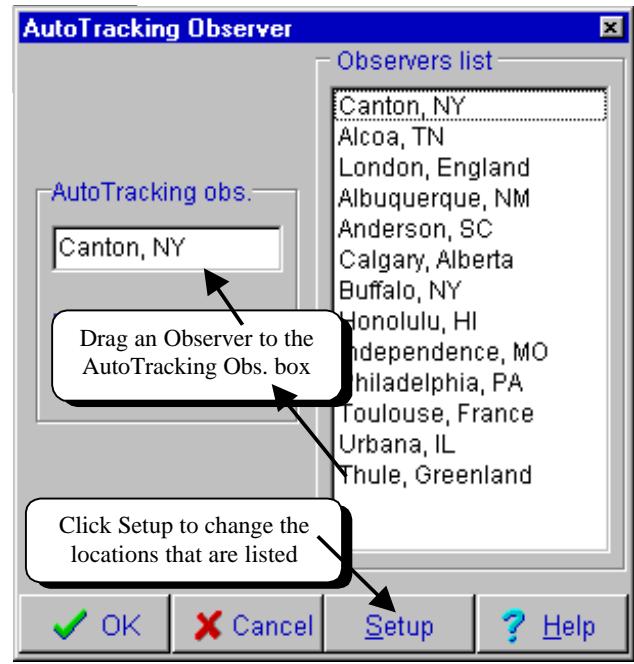
AutoTracking Observer selects the observer that will be used as the AutoTracking Observer. The list presented in this screen is the "short list" that is built in the Setup/Observers screen. In other words, you select the AutoTracking Observer from a list that is itself taken from the large Cities, EME Database, and DXCC countries lists.

AutoTracking Satellite selects the satellite that will be followed by the antennas during AutoTracking. Drag a satellite name from the list to the rectangular box labeled AutoTracking Satellite. Satellites may be drawn from groups in the same manner as in the Individual View Configuration screen.
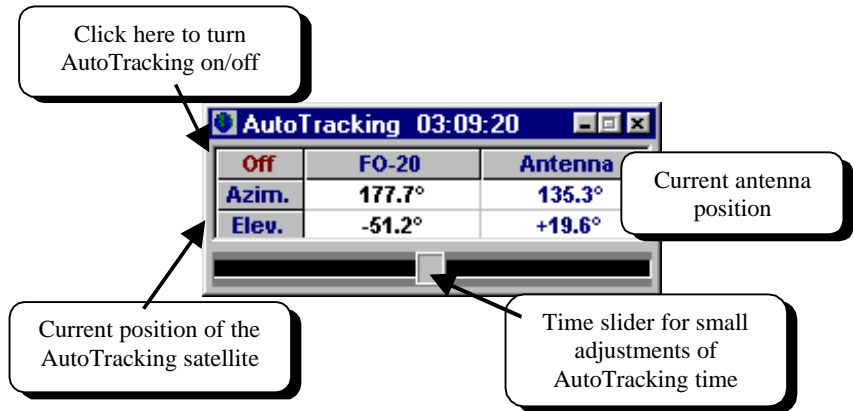
Configure Rotator accesses a screen for setting up and calibrating the antenna rotator and its interface. This screen is also available through the Setup entry on the Main Menu; please see its discussion for selecting the antenna control interface, calibration, etc.

Summary
Hide title bar
AutoTracking Observer
AutoTracking Satellite
Configure Rotator

AutoTracking Observer

Observers list
Canton, NY
Alcoa, TN
London, England
Albuquerque, NM
Anderson, SC
Calgary, Alberta
Buffalo, NY
Honolulu, HI
Independence, MO
Philadelphia, PA
Toulouse, France
Urbana, IL
Thule, Greenland

AutoTracking obs.
Canton, NY

Drag an Observer to the AutoTracking Obs. box

Click Setup to change the locations that are listed

OK   Cancel   Setup   Help

AutoTracking Satellite

Satellites
AO-10
STS-83
Mir
AO-27
AO-21
AO-16
FO-20
FO-29
LO-19
KO-23
KO-25
IO-26
UO-22
UO-14
UO-11
WO-18

AutoTracking Satellite
Mir

Drag a satellite to the AutoTracking satellite box

Groups
Complete
Naturals
Ham Sats
GPS
Meteor WX
Russian

Click on a Group name to view its contents

OK   Setup   Help

AutoTracking Status Box

The AutoTracking Status Box is a compact display of the AutoTracking satellite's current position as well as the orientation of the antennas. It also provides the capability to turn AutoTracking on/off by mouse-clicking the upper left corner cell.

Right-click the mouse on the AutoTracking Status Box to view a summary of the AutoTracking Satellite's current conditions.

Click here to turn AutoTracking on/off

Off	FO-20	Antenna
Azim.	177.7°	135.3°
Elev.	-51.2°	+19.6°

Current antenna position

Current position of the AutoTracking satellite

Time slider for small adjustments of AutoTracking time

*The **Status Bar** is visible on-screen if an antenna control interface has been selected in **Setup/Antenna Rotator***

Additional AutoTracking Information

Nova for Windows is different from other satellite tracking programs. It does not require memory-resident DOS drivers ("TSRs") in order to control antennas through hardware interfaces such as the SASI Sat Tracker.

Most antenna control interfaces are supplied with a diskette containing programs for calibrating and driving the interface *under DOS*. These programs are not needed for Nova for Windows. You do *not* need to install or run any of these programs.

Installing AutoTracking Interfaces

♦ **SASI Sat Tracker and AEA ST-1** : Plug the interface into an available parallel (printer, "LPT") port and connect the cable to the G-5400 rotator control box.

♦ **Kansas City Tracker and RIF-PC** : Plug the interface card into an available 8- or 16-bit ISA slot and connect the cable to the G-5400 rotator control box.

♦ **M² RC-2800P** : Plug the computer-interface cable into an available serial ("COM") port and connect the cable to the RC-2800P rotator control box. If a second control box is used for elevation control, daisy-chain the control boxes together with a DP-9 serial cable.

All interfaces: Start Windows and launch Nova for Windows. Under Setup/Antenna rotator, select the appropriate interface from the pull-down list. If necessary, change the port settings in the boxes below the pull-down list. Nova for Windows is ready to control antennas. For greater pointing accuracy, also fill in values in the Calibration Page.

Additional information for Nova for Windows 32 (Windows '95 and Windows NT):

If you will be using a parallel (printer) port antenna control interface (such as the SASI SAT Tracker) with *Nova for Windows* **32**, then you MUST disable the printer port from within Windows '95 (or NT). If you do not disable the printer port, *Nova for Windows* **32** may not be able to communicate with the antenna control interface.

For Windows '95:
1. Click "Start"
2. Click "Settings"
3. Click "Control Panel"
4. Choose "SYSTEM"
5. Choose "Device Manager"
6. Click on the "+" sign next to "Ports" (this expands the list)
7. Single-click to highlight the Printer Port to which the antenna control interface will be connected.
8. Click on the "Properties" button below the window
9. Find the white box in which "Original configuration (current)" is written
10. Click on the box next to "Original configuration (current)" to **UN**-check it.
11. Click "OK"
12. Click "Close"   (continued...)

For Windows NT*:*
1. In the Main program group, select "Control Panel"
2. Inside Control Panel, select "Devices"
3. Scroll down through the list of devices until you come to "ParPort."
4. Highlight "ParPort"
5. Click "StartUp"
6. Choose "Disabled"
7. Click "OK"
8. Repeat Steps 5-7 for the "Parallel" entry (just above "ParPort").
9. Click on "Close"

Nova's ToolBar

The ToolBar provides fast access to the most commonly-used functions in Nova for Windows. Each View contains a ToolBar. Clicking on ToolBar buttons avoids several steps of menus.

The function of each button is shown on the diagram below. The top row of buttons affects the time within a View. You may move forward or backward in time in either small or large steps. The actual time assigned to each step may be set by right-clicking on the View and selecting *View's clock*. The time-step buttons can be locked down by pressing the Shift key while muse clicking on one of the buttons.

The middle row of buttons control the appearance of the View and what kind of map is displayed, if any. You may quickly jump among map styles with these buttons.

The bottom row of buttons formats the Views' shape and the appearance of its maps. You can also set up Satellite Script tracking and launch a new View easily.
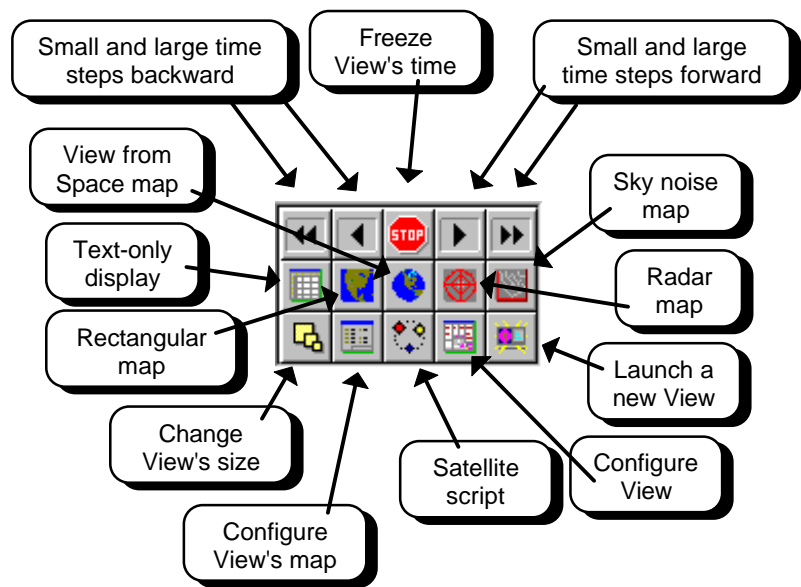
*Nova for Windows' floating **ToolBar** provides access to the most frequently-used functions.*

Sound Alarms

Pressing the [🔊] button in the Individual View Configuration screen opens a window where sound alarms are configured. Sounds are configured separately for each View.

The Setup Sounds window (right) has three pages: AOS, TCA, and LOS. **AOS** sets the sound that will be played just before the satellite rises above the 1st Observer's horizon. **TCA** sounds play immediately before the sound reaches it Time of Closest Approach, and **LOS** occurs before the satellite passes below the horizon.

Select the sound that will be played from the drop-down box. Each box contains the names of sound files (in the .WAV format) that Nova for Windows finds in the folder NovaWin\Sounds\Noises. Other noises may be added by copying new WAV files to this folder.

Satellite names are stored in the \Novawin\Sounds\Satellites folder. They are arranged by the NORAD catalog number of the satellite. For example, Mir's catalog number is 16609 so its name file is 16609.WAV. You can easily record new satellite names or replace those supplied with Nova for Windows. Windows '95 and '98 include a simple sound recording utility in the Accessories/Entertainment folder.

Sound alarms are set for each View individually. You can choose to enable notification of AOS and/or LOS,

Star Display

Nova for Windows can display the brightest 1,600 stars against the Radar Map (shown) and the Sky Temperature map. Enable this feature in the appropriate map configuration screen accessed by pressing the [📑] Configure maps button on the Toolbar of each View. Moving the cursor over a star will display its RA/Dec, name, and visual brightness.
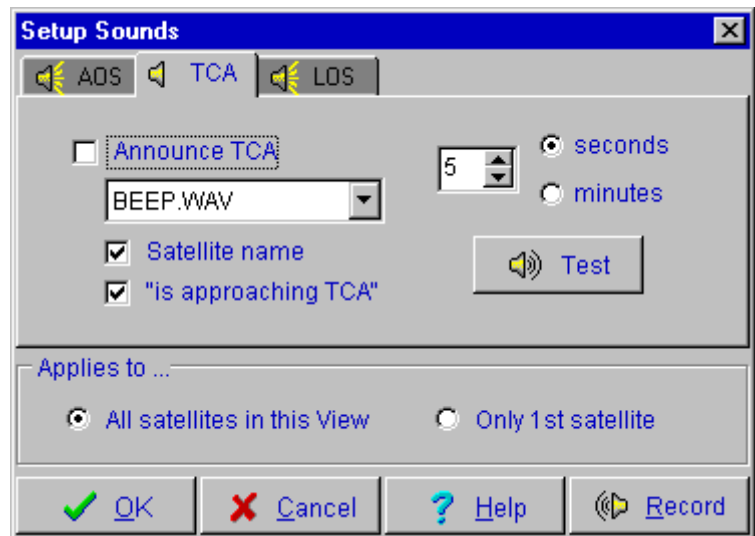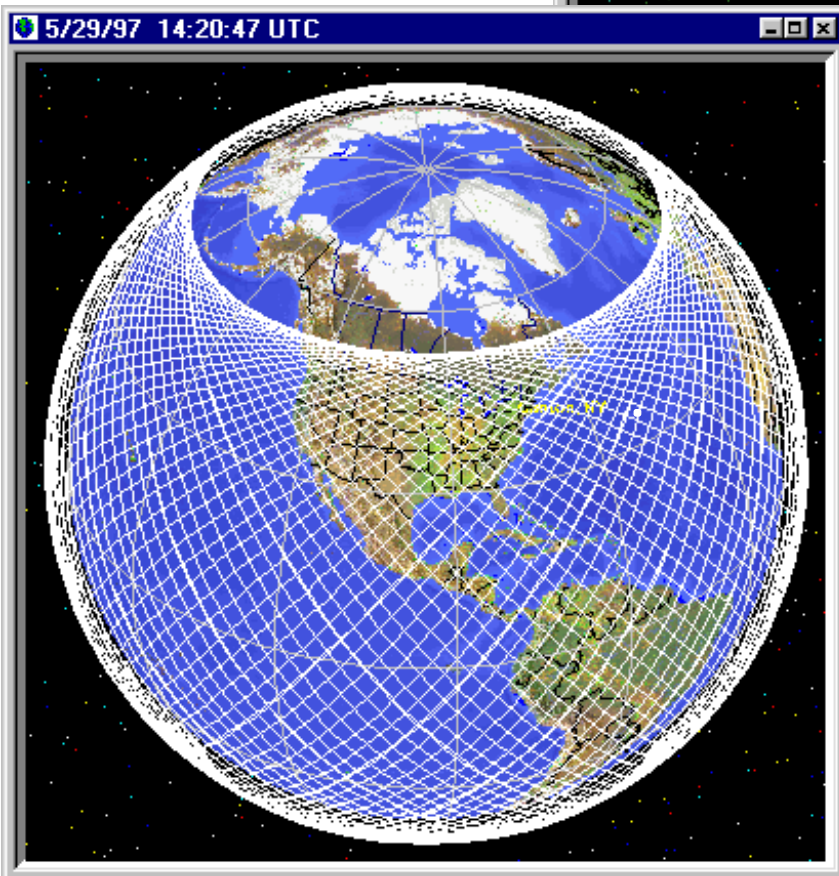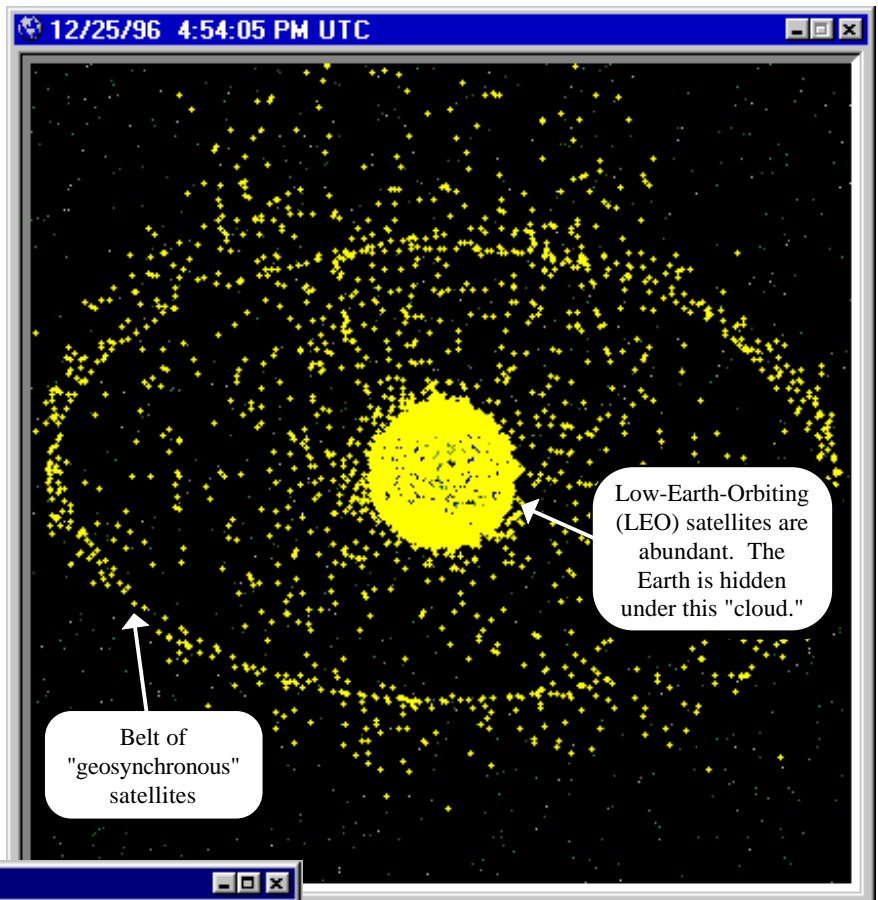
statement of the satellite's name, and the words "is rising" or "is setting." Click on the Test button to hear what the announcement will sound like.

The time before the AOS or LOS event when the sound alarm will be played is specified in the spin box. In the example, sounds will play 10 seconds before AOS and before LOS of all satellites in the View.
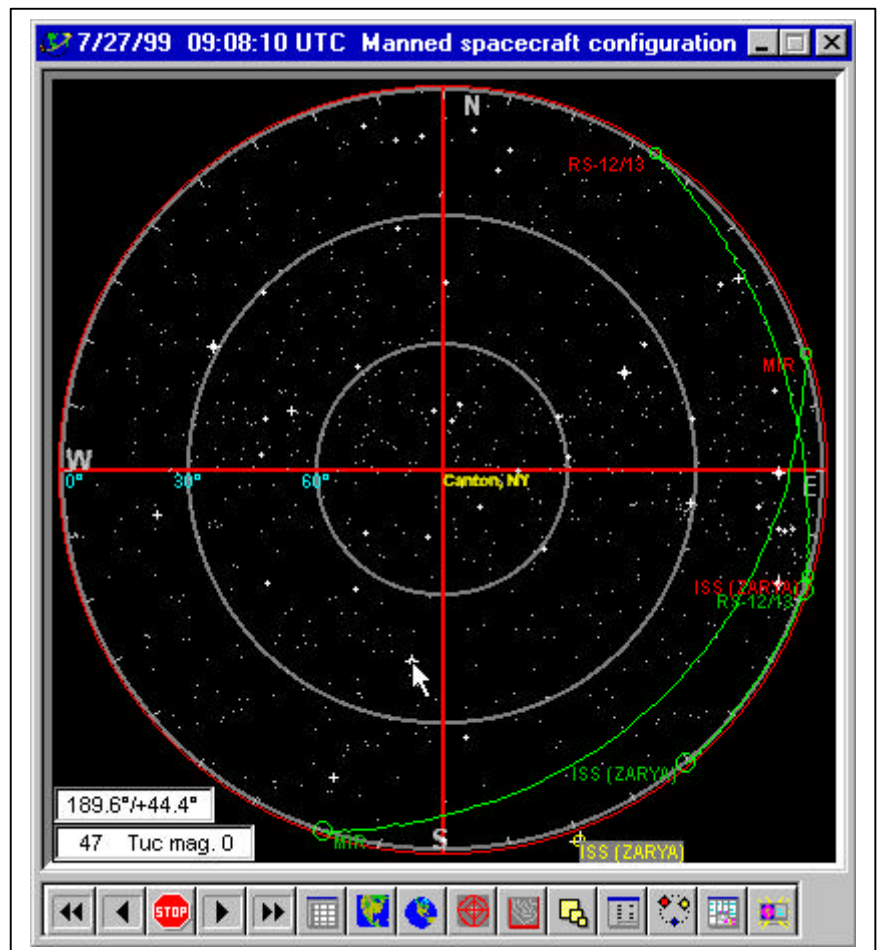
Interesting Activities

Nova for Windows' flexibility enables several interesting possibilities. For example, you can display positions of an unlimited number of satellites simultaneously. The figure to the right shows a real-time display of 4,700 satellites. Such a display is not especially useful for tracking but it does provide an intriguing perspective on the distribution of satellites in the near-Earth environment. The map was created by acquiring a large Keplerian data set and using the "Complete" group (minus natural satellites), setting the View from Space map to Orbit Display, number of orbits=0, show satellites. With this large number of satellites, one must be somewhat patient.

12/25/96 4:54:05 PM UTC

Low-Earth-Orbiting (LEO) satellites are abundant. The Earth is hidden under this "cloud."

Belt of "geosynchronous" satellites

(above) **View from Space** *map with 4,700 satellites displayed. Somewhere under the central cloud of L.E.O. satellites is the Earth.*

5/29/97 14:20:47 UTC

(left) **100 orbits of the Russian Mir space station.** *This display shows the web-like pattern of repeated space tracks and the "hole" above about 57° latitude where the satellite never passes.*

Frequently Asked Questions

Q: I just installed my registered copy of Nova for Windows but it says that it is a "demo." What should I do?

You have apparently made a mistake in entering your serial number during installation. You must re-install NfW from the original disks, making sure to enter the full serial number including the **NLD-** prefix.

Q: How do I update Keplerian Elements?

See page 11.

Step 1: Acquire a computer file of new Keplerian elements. There are many sources of these files. We prefer the internet site maintained by Col. T.S. Kelso, Ph.D. of the U.S. Air Force: **http://www.celestrak.com** Other sites are maintained by AMSAT and other organizations.

Step 2: In Nova's Main Menu, go to Setup, then Satellites.

Step 3: In the Setup/Satellites screen, click on the [Update] Update button.

Step 4: In the pop-up box that appears, select Update again.

Step 5 : At the next prompt, tell NfW the name of the file that you downloaded in step 1.

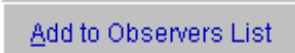*Step 6:* Click OK and NfW reads the file and updates all Keplerian elements in a few seconds.

Q: How do I hook up my antenna interface?

See page 15, Setup/Antenna rotator.

Q: How do I tell the program about my location?

Step 1: Go to the Main Menu, Setup, then Observers.

Step 2: In Setup/Observers, see if your town is listed in the Main Database (the one on the right side of the page). If it is there, then drag it to the short list on the left. If it is not in the Main Database, do the following:

- Fill in the blanks in the <u>Edit Location</u> in the lower left corner of Setup/Observers. Enter your town's name, its latitude, and its longitude.

- When all entries are completed, press the [Add to Observers List] button to add this new location to the short list. You may also want to

press the [Make AutoTracking Obs.] button if you wish to AutoTrack from this location.

Step 3: Exit the Setup/Observers screen by pressing OK.
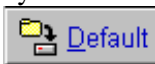
Step 4: Click on the View that you wish to configure with your location.

Step 5: Right-click the mouse <u>within the View</u> to reveal the pop-up menu. Select *Configure View.*

Step 6: In the **Individual View Configuration** screen, find your town in the short Observers list on the far right side of the screen. Drag the name toward the middle and drop it in the Observers box under **Current Configuration**.

Step 7: Click OK and you're finished.

Step 8 (optional): If other Views have already been launched, repeat steps 4-6 as necessary.

Note: If you want all new Views to have your location automatically used when the View is created, click the [Default] Default button before leaving Individual View Configuration.

Getting Help

Nova for Windows includes context-sensitive Help on almost every Setup or configuration page. In addition, small pop-up hints appear near buttons if they have been enabled in Setup/General.

Northern Lights Software Associates welcomes your e-mail comments, suggestions, and criticisms at **nlsa@nlsa.com** or **nlsa@northnet.org**.

If necessary, you may telephone NLSA at (315) 379-0161 Please have your **serial number** available. NLSA's FAX number is the same as the voice number.

NLSA's Web page is **http://www.nlsa.com**

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