HEAVENSAT

(NOTE : For Version 1.98)

Updated 16 Dec 2006

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1. Introduction

HEAVENSAT is a program written by Alexander Lapsin for the visual tracking of artificial earth satellites.

The program has no documentation and I volunteered to write a manual as such an outstanding program deserved a manual and rather than have him spending his time writing a manual instead of programming improvements I would do the manual.

PLEASE NOTE : Any errors introduced are probably due to me and if a better way of doing a particular task is obvious to you then by all means let me know so that this manual can be updated.

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2. Features

HEAVENSAT was developed for the visual satellite observer. I happened to come upon it on the Internet and immediately knew that this was THE program I had been looking for in my video tracking of satellites.

Some features of the software :

- Show a view of the sky for any date,time and location.
- The program can show in real time a view of the sky that will contain any satellites in the database in use that are in the field of view at that moment.
- Can handle any sized database - a database containing more than 10000 satellites has been tested with no problems.
- One can watch a particular area of the sky and watch satellites cross the field of view
- One can lock on a satellite selected and follow it across the sky and see which other satellites are in the field of view of the main target.

There are many other features which I have yet to explore!

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3. Installing the program

Download the following files:

(1) OpenGL version of HEAVENSAT1.97 (previous version),file size 4.7 Mbytes

(2)HEAVENSAT198glPatch.zip file size 473 Kbytes.

(3) Microsoft VC80.CRT 0.6 Mbytes

(4) Sky2000 Master Catalog V4 11.1 Mbytes.

With your unzipper (WINZIP/WINRAR whatever)- click on HEAVENSAT197gl.ZIP and extract to **C:\Heavensat**

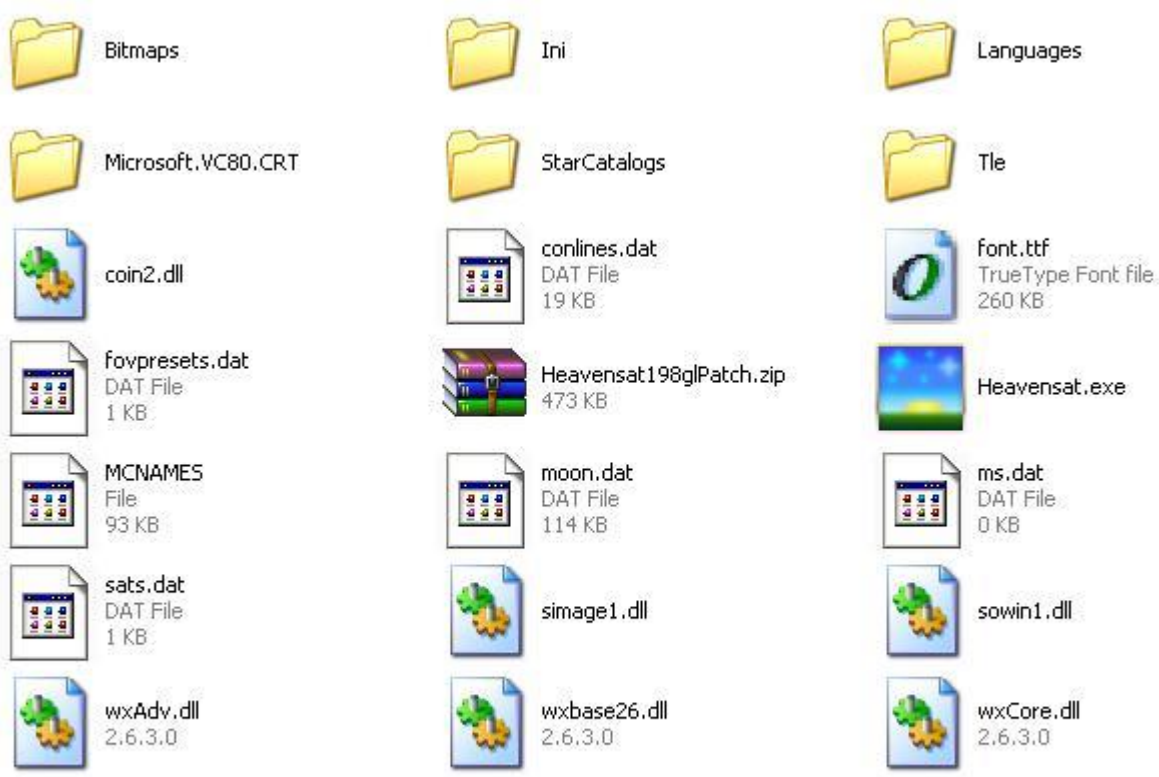
It should do this and you will have a directory structure **C:\Heavensat\Heavensat197gl** and all the files and created subdirectories will be in the sub directory **"Heavensat197gl"**.

Now a bit of fiddling - copy all the files in this directory(ie the one marked **"Heavensat197gl**" into **C:\Heavensat** . Having done this then delete the subdirectory Heavensat197gl.

Unpack Heavensat198glPatch.zip to the Heavensat directory and make sure all the new files unpack into their respective directories. Now click on **Microsoft VC80CRT.zip** and extract to **C:\Heavensat** Click on **Sky2000.zip** and extract to **C:\Heavensat.**

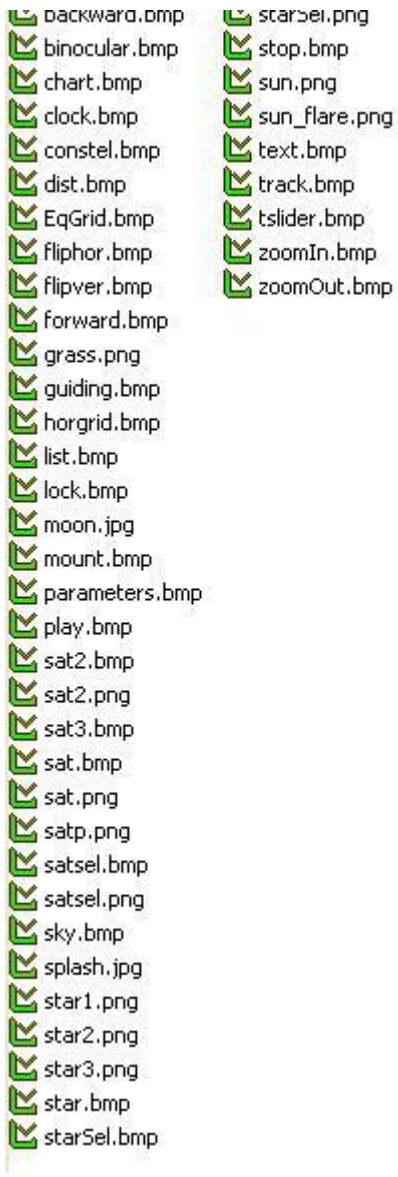
It should now all be okay but if not this is the directory structure I have on my PC:

In the root directory its called HEAVENSAT which has subdirectories and files as shown :



The subdirectories contain :

BITMAPS:



INI:

LANGUAGES:

Microsoft.VC80.CRT:

Star Catalogs:

TLE:

NOTE :TLE - has a sample TXT file. Suggest you delete this and put in your own elements database. Extension TXT or TLE okay. I put in the large SPACETRACK ~8500 version plus CLASSFD.TLE.

All this is quicker to do than try and explain :-))

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4. Starting the program.

All should now run okay when you click on HEAVENSAT.EXE.

Click on 

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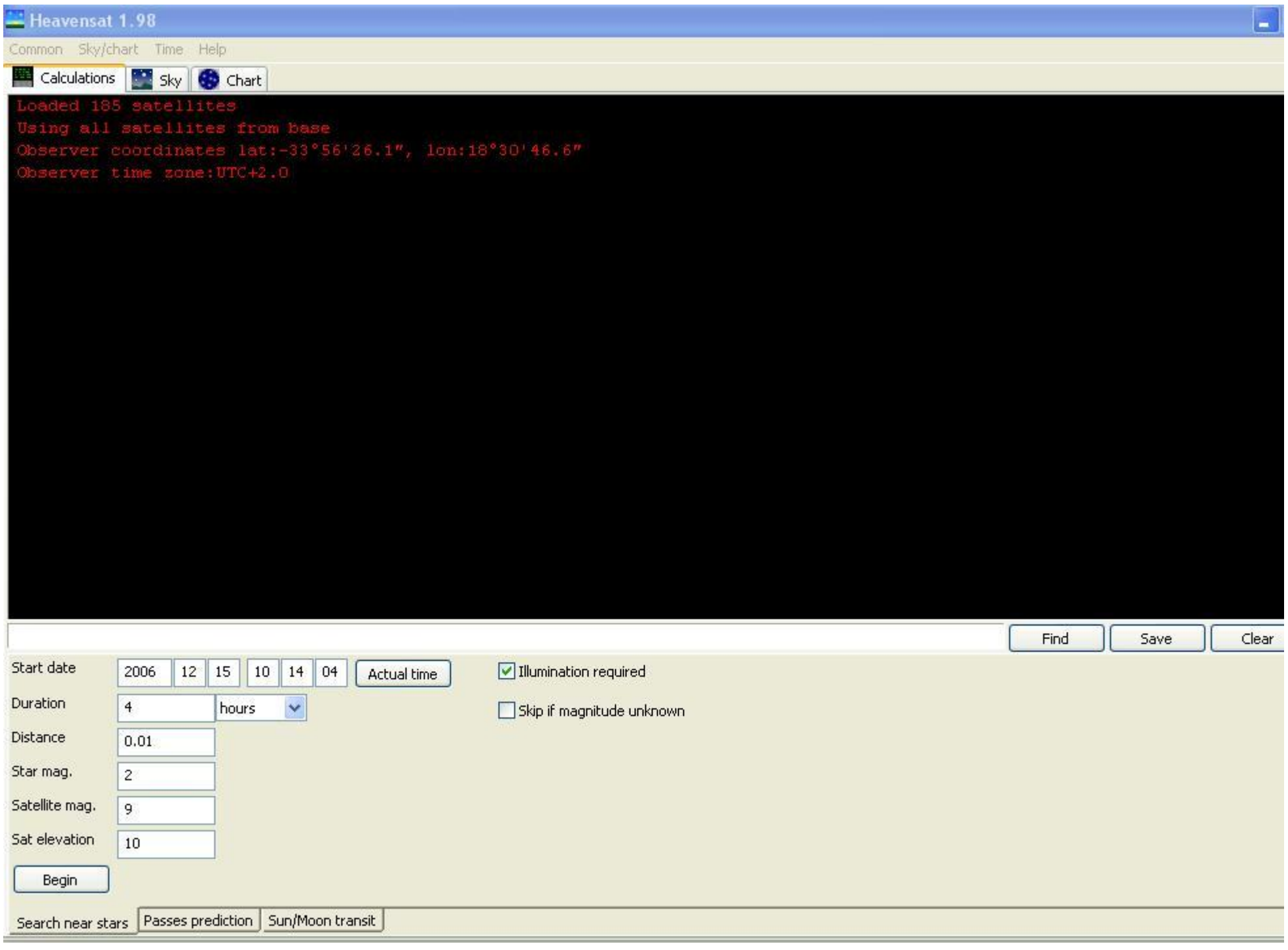
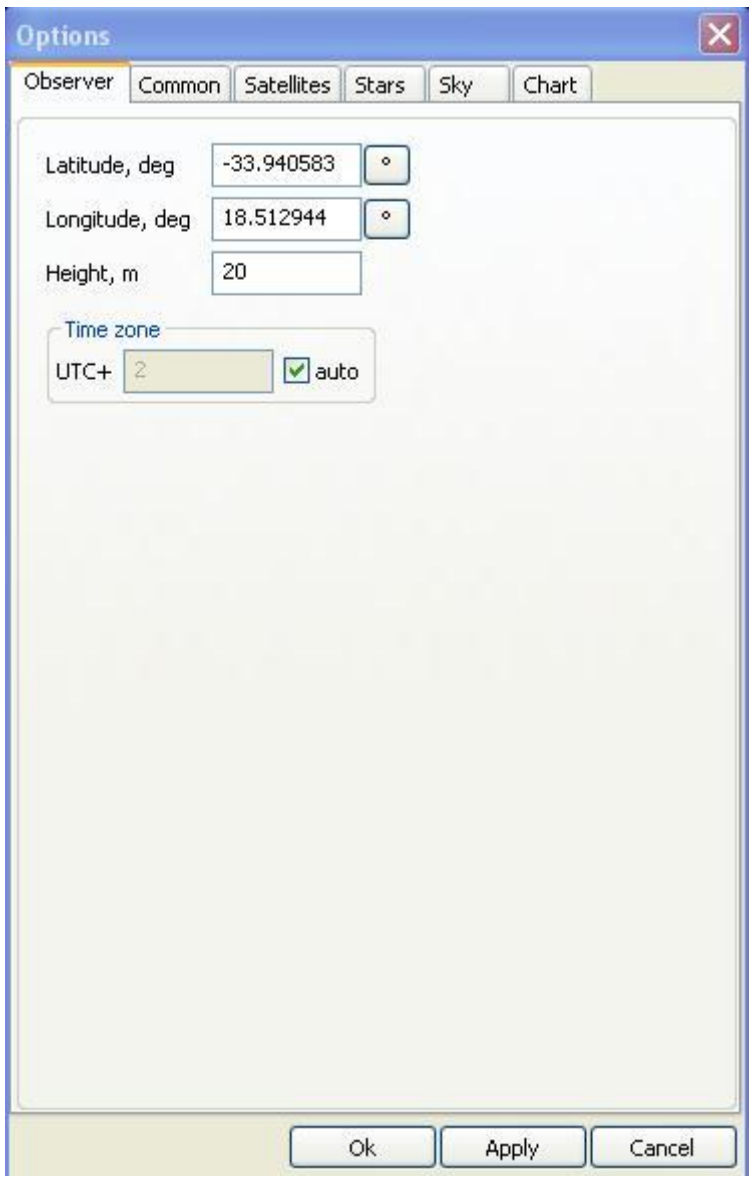
The following screen should appear :



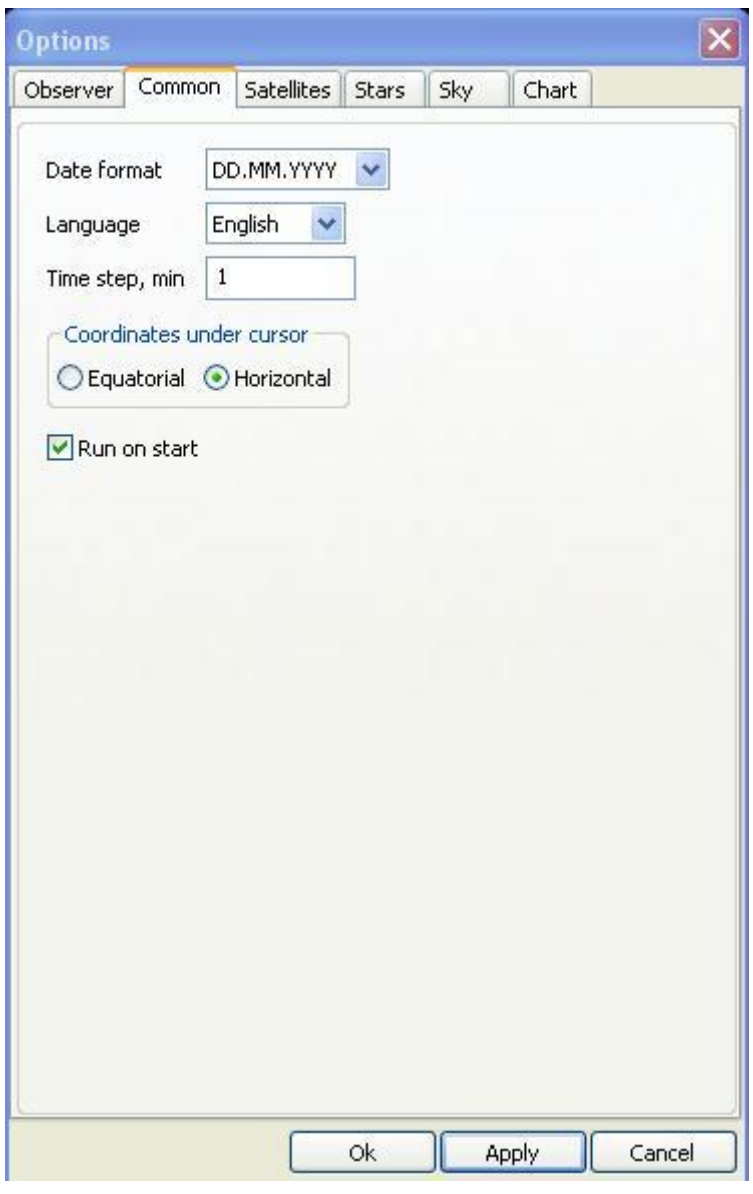
5. Setting up the various OPTIONS under COMMON.

As with any program running for the first time it is necessary to set up certain values. Click on **COMMON** , found top right corner and a new sub-screen will appear called **OPTIONS**



The first data applies to the observer so fill in the required details and then click **APPLY**

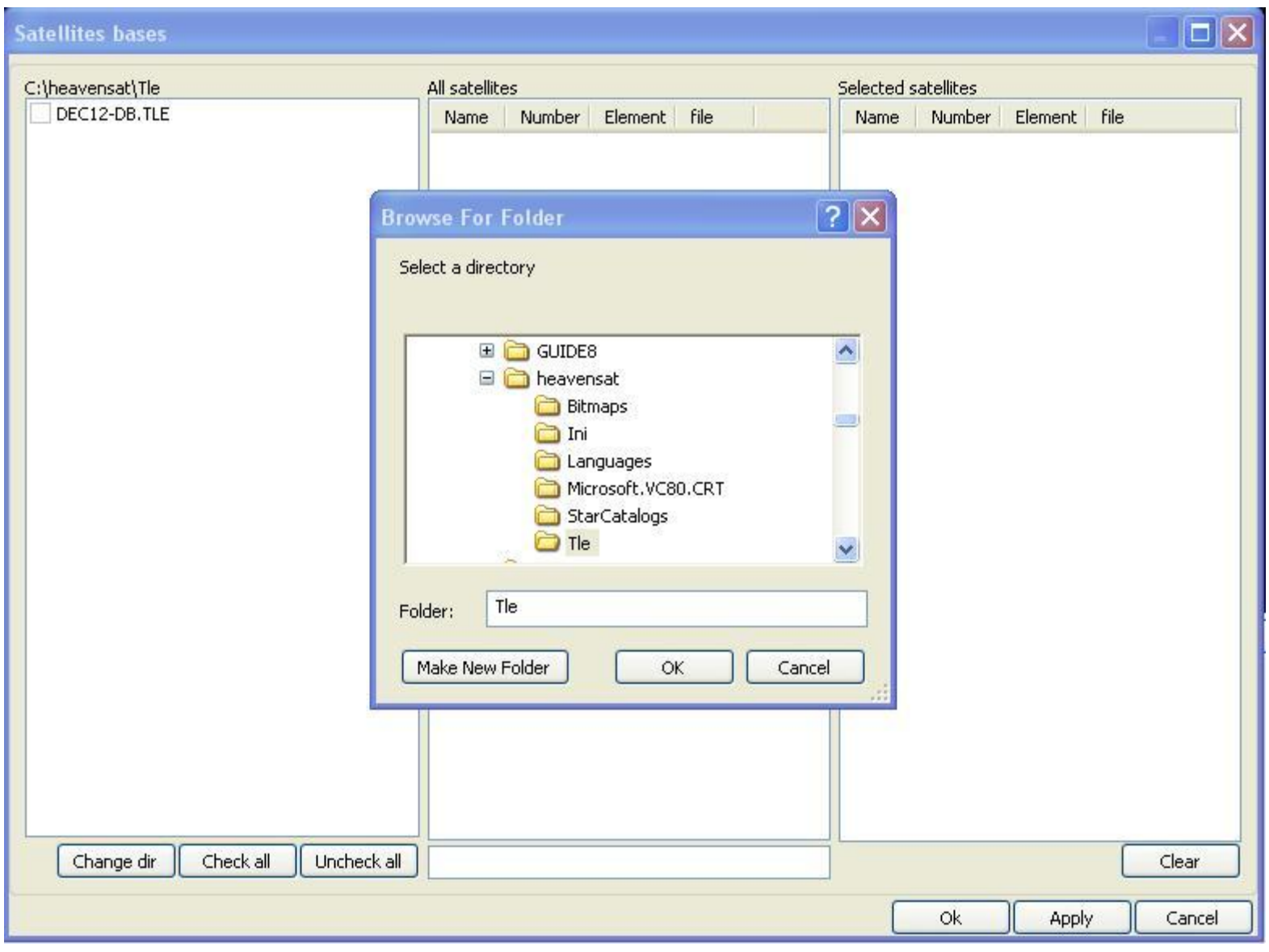
Now click on **Common** and see if there is anything you want to change.



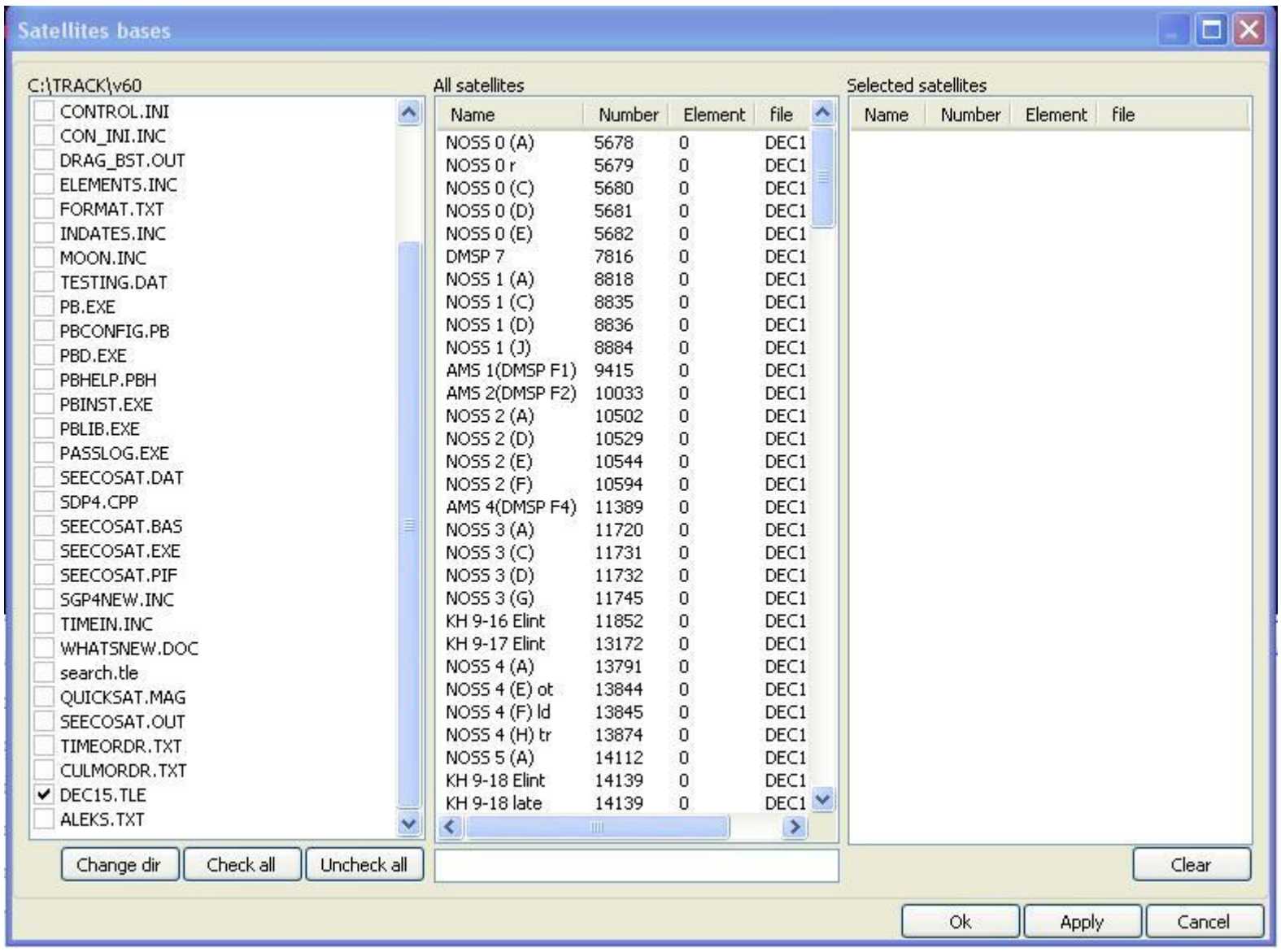
When satisfied press **APPLY**

Now click on **SATELLITES** and you will get a screen similar to that shown

You may wish to have your elements file in another directory. For example in directory c:\track\v60\. Click on **Select** - on right hand side of this screen, then click on **CHANGE DIR** at foot of screen. A new screen appears



Move the vertical slider bar to search for the directory you want and find your TLE file and click on it

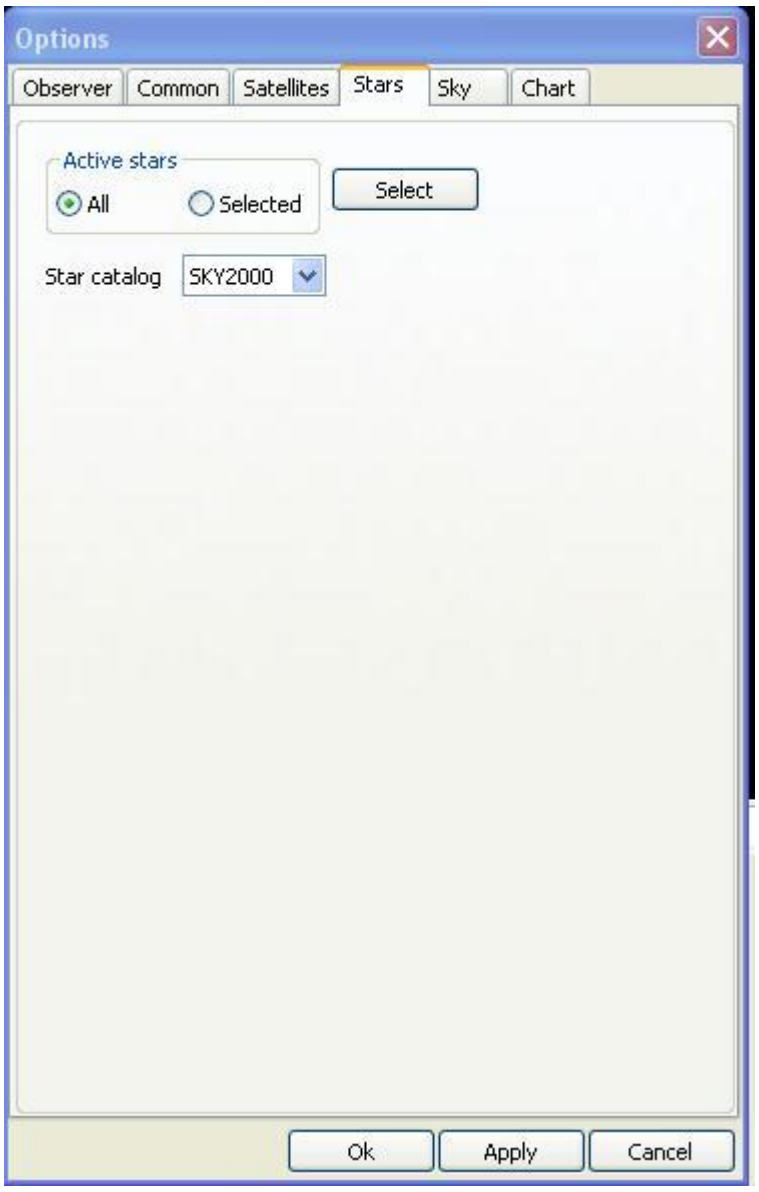


the elements should appear in the central column. Click on **APPLY** and then **Ok**

One is offered the chance to change the colour of the satellite- I like mine yellow as I can then see they are "sunlit". The satellite will change colour to blue when in earths shadow. The **MARKER** option allows one to identify a selected satellite with a symbol. Choice #1 is the smallest and #10 the largest. Around #5 is best but I prefer the **MARKER** off. The final choice is the **POINT SCALE**. This controls the size of the satellite on the screen with #1 being smallest and #8 being the largest. Around #4 is about the best.

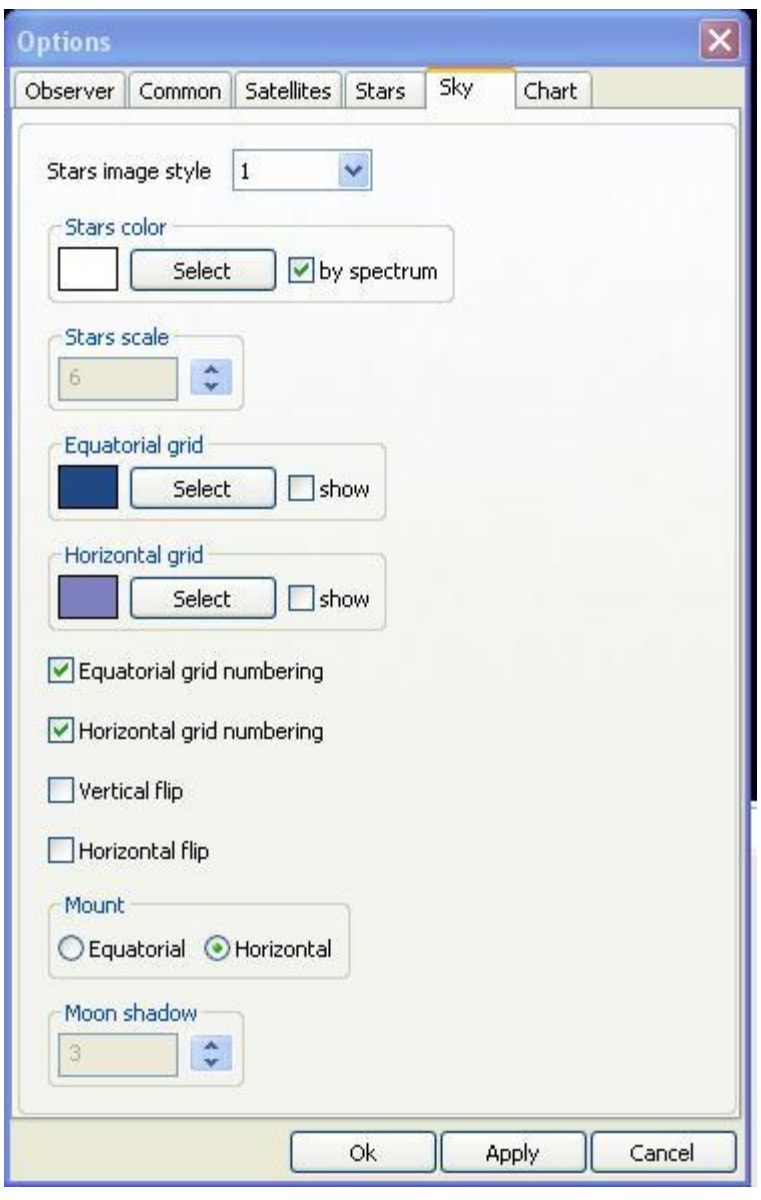
One is allowed to choose the prediction algorithm used - the first choice is the original SPACETRACK #3 report which contained some errors. The second one is the updated reported released in August 2006 and the third one is the implementation by Bill Gray of PROJECT PLUTO of the August 2006 report. Choices #2 and #3 will probably give the same answers but the code by Bill - ie #3 - runs a lot faster than #2. One can switch "on the fly" from one algorithm to the others and therefore see what effect it has. Finally one can choose the geophysical model used - I don't know much about this but don't think it will make any material difference as to which is used.

Now click on **STARS**. Select the star catalog you want to use- you should have the option of two. Choose the one you like.



Click on **APPLY**

Next click on **SKY**. For the moment accept the default values shown- you can always change them later and see what effects the have.

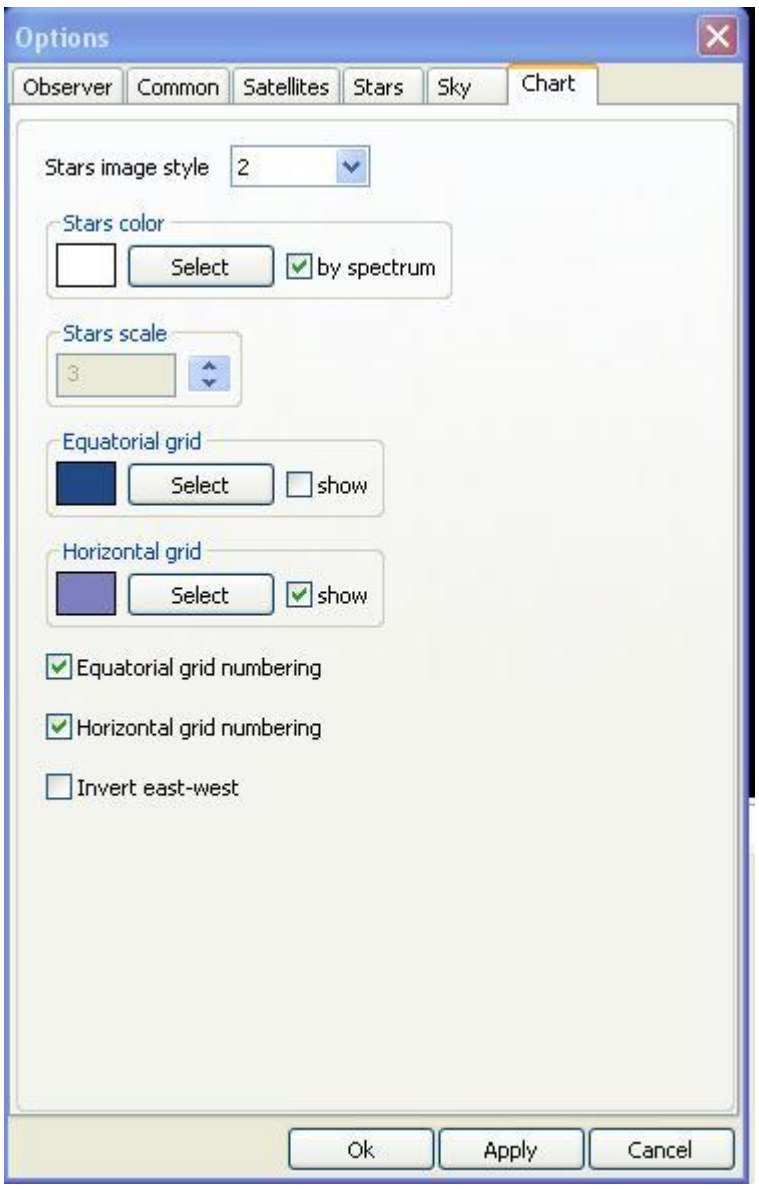


Exploring the options offered:

- **Stars Image Style**. #1 gives most realistic appearance, #2 gives big diameter stars and #3 gives the smallest. I prefer option #1.
- **Stars Scale**. #1 is least diffuse image whilst #20 most diffuse. Around about #10 is okay.
- **Stars Colour**. Select Spectrum as this will then match the spectrum of the star which gives an indication of the star colour.

Click on **APPLY**

Finally click on **CHART**. For the moment accept the default values shown - you can always change them later and see what effects then have.



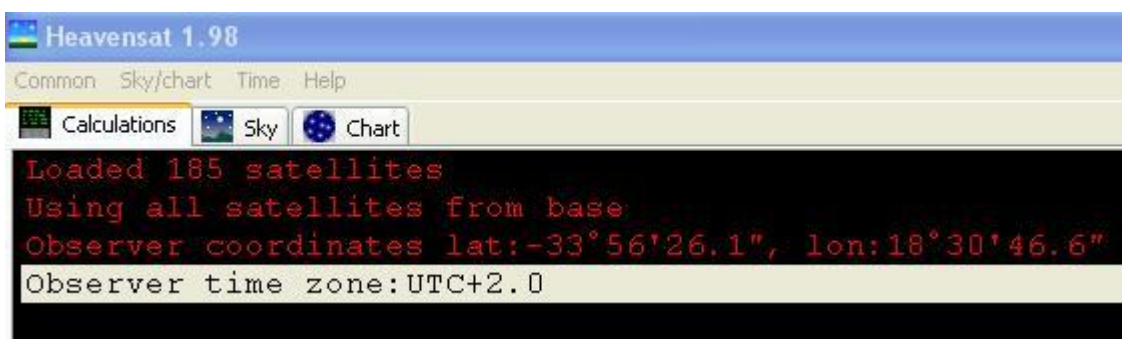
The options offered here apply to the **CHART** view and have the same meaning as for **SKY** so again its a matter of personal choice.

Click on **APPLY** and then **OK** and you will be returned to the main screen again.

6.Ready to go

Things now get pretty hectic as so many things can be done so for the moment instructions to get started will be given and you can then explore further.

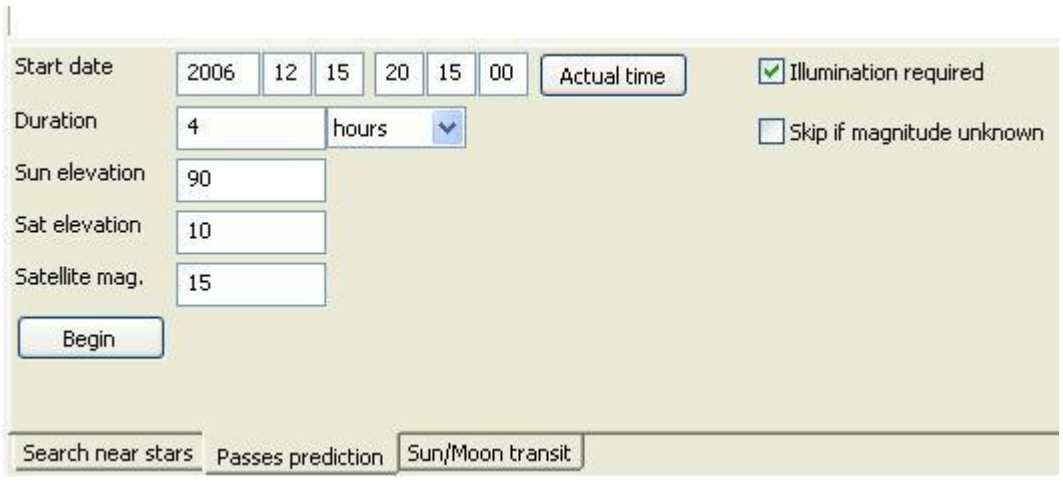
Assuming all set up correctly, when you load the program the screen will display the number of satellites loaded, your coordinates and the time system.



Now go to the lower half of the screen where you will see you can select three options, namely

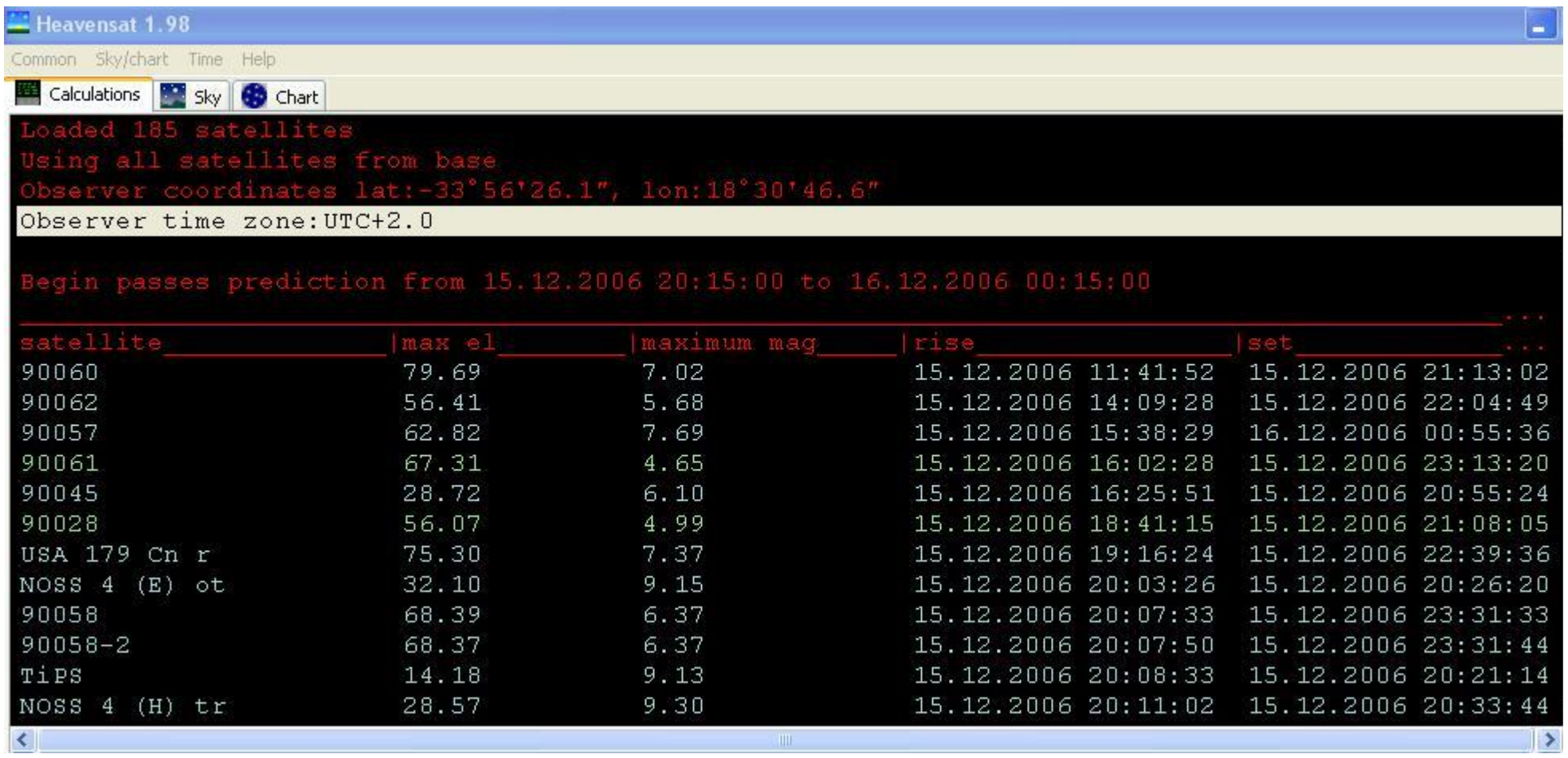
- Search near stars.
- Passes prediction.
- Sun/moon transit.

These are self explanatory so it will be left to you to explore but for the moment let us choose the second option, namely **Passes prediction**.



Enter the start date and time and make sure **Illumination required** is checked. Also enter the **Time duration** and the **Minimum satellite elevation** , typically 10 or 15 degrees. Finally enter the **magnitude of the faintest satellite** you hope to track.

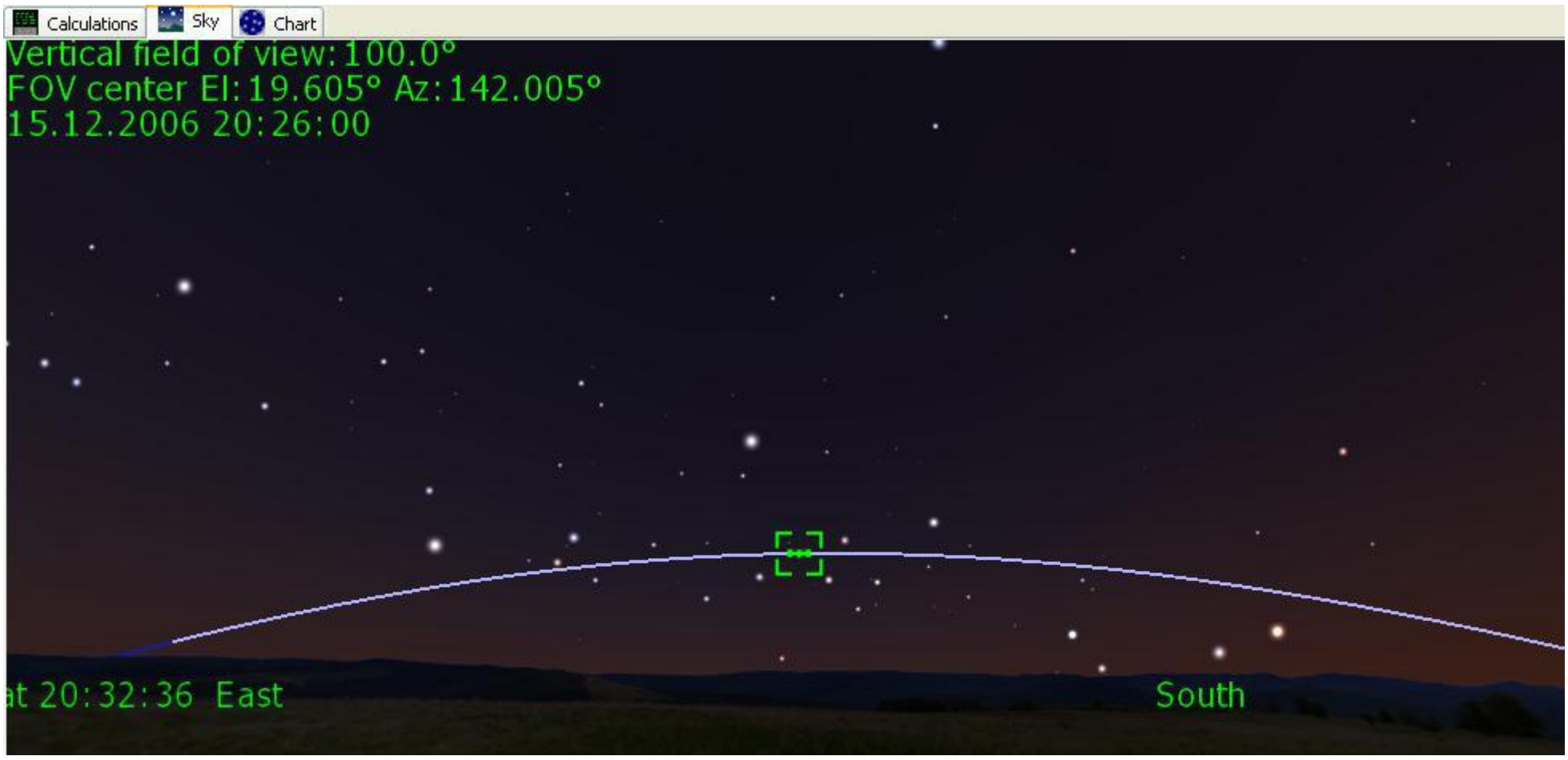
Press **BEGIN** and the passes will be shown on the screen.



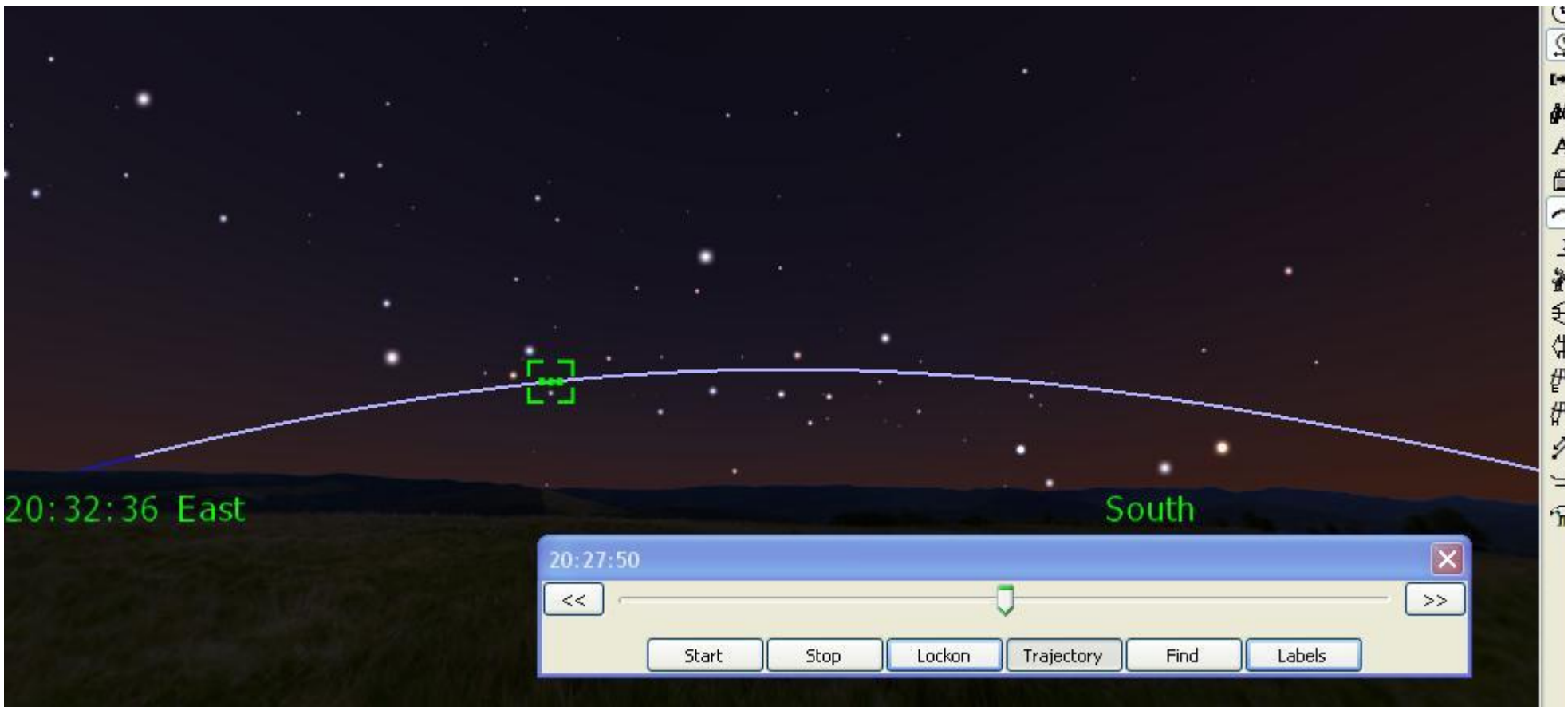
NOTE Currently geostationary satellites are **NOT** shown on this screen at this stage.

As an aside, if you click on **CHART** at this time it will show the satellite situation at the time of the pc clock and **NOT** the start time selected. More later. The same applies if you select **SKY** at this point. Changing the time using the option in the Right hand column also does not affect these displays. These views are only changed once you have performed the next step.

Look through the list of satellite passes shown on the screen and select one of interest. Let this be **Lacrosse 5**. Click on it and a new screen will appear and show the trajectory of Lacrosse 5.



You can examine this pass in greater detail by clicking on the **Slider Bar** which is 7th item down in the icons on the RHS of screen. This slider has a coverage of 10 minutes and the start and end times can be changed by clicking on the double arrows at each end of the slider bar.

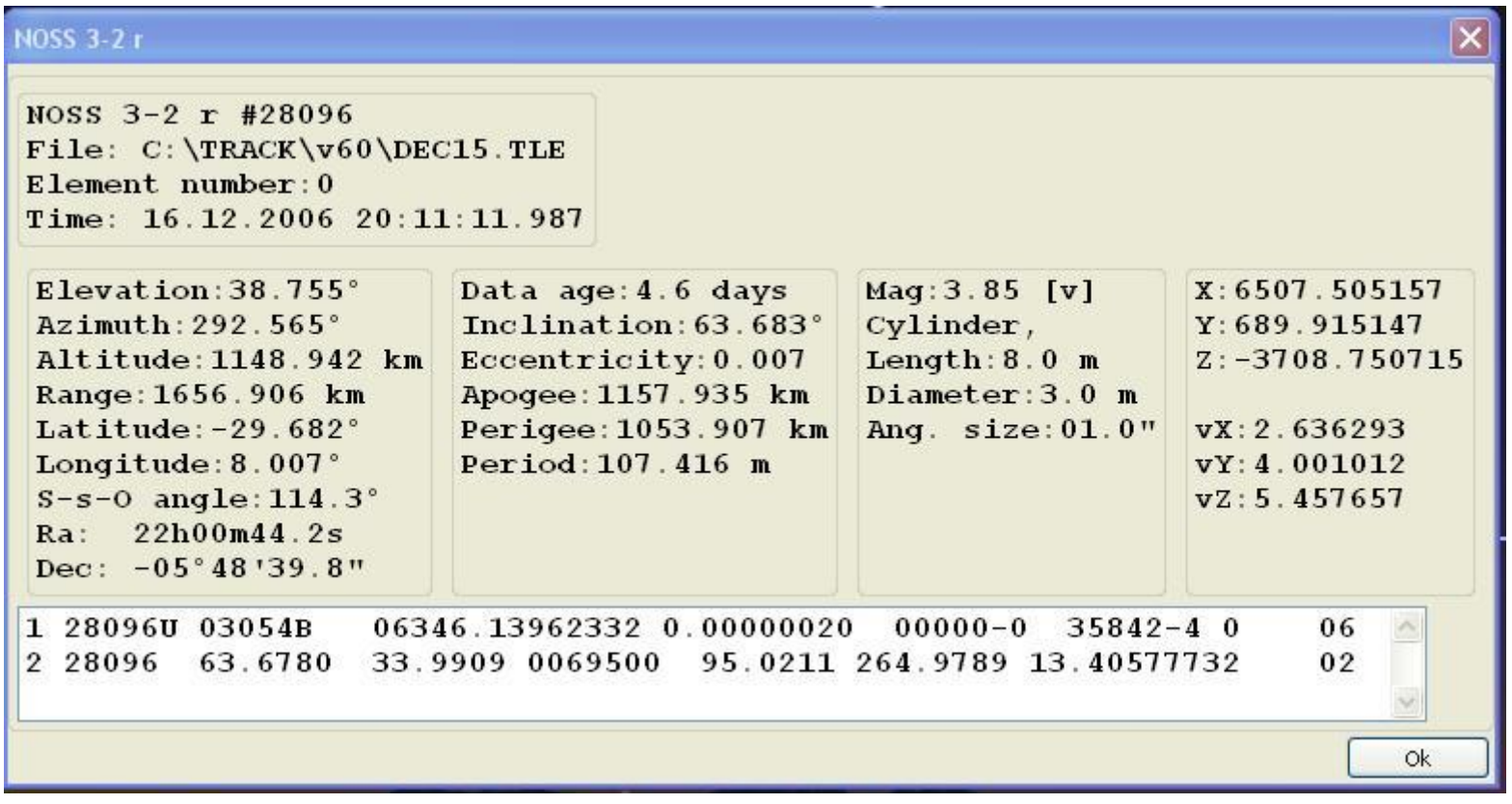


Experiment with sliding the slider in this bar. Note that you can also drag the sky around by left clicking the mouse in the screen and holding the mouse down whilst you drag the sky.

If you **right** click on the satellite you are shown several options, eg

- object information.

Clicking on this will show a wealth of detail as shown in the picture below:



ı center object.

This should not present a problem - it centers the object on the screen

ı Add to selected list.

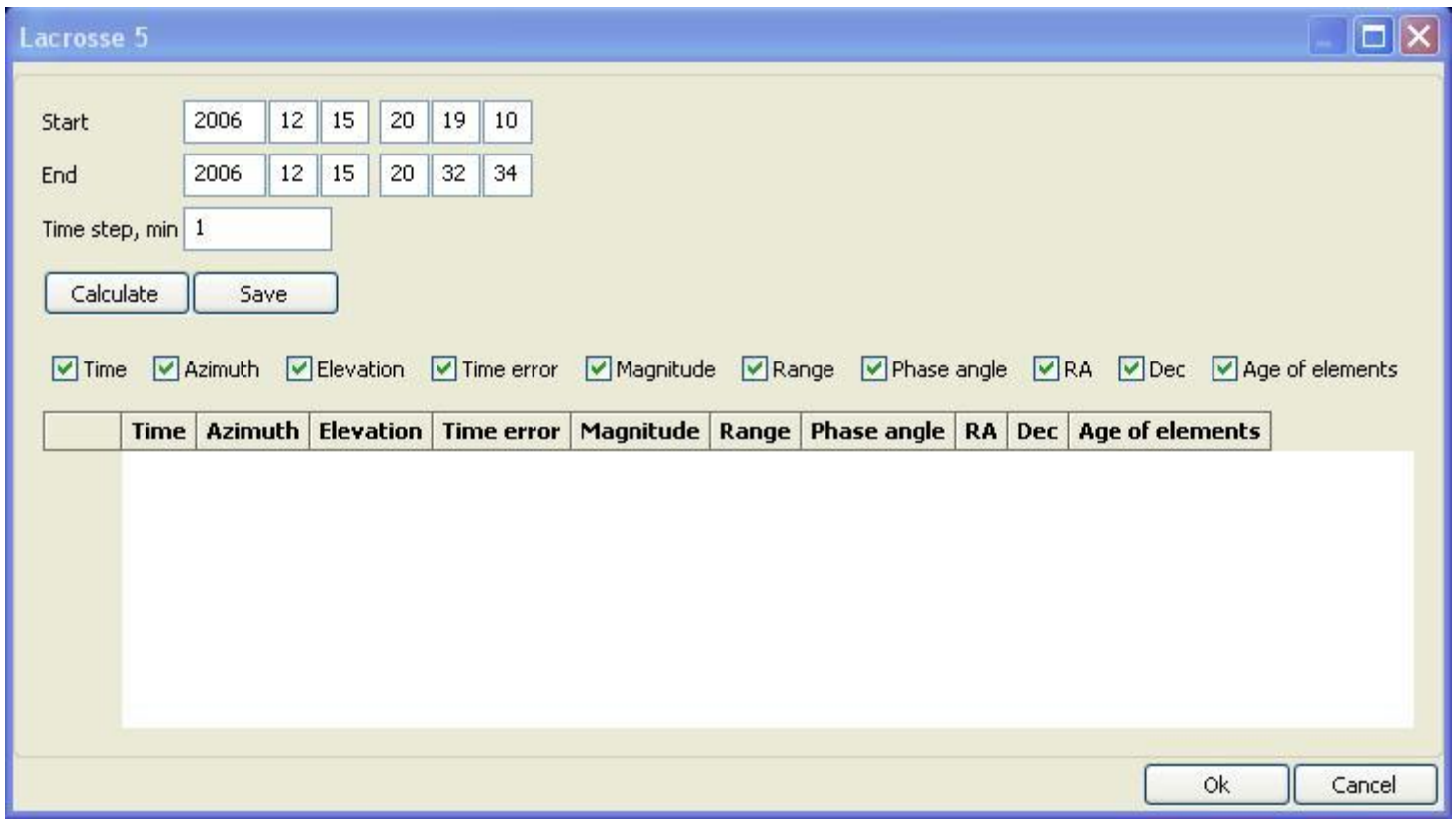
I have still to examine this option and how to use it.

ı Add current event.

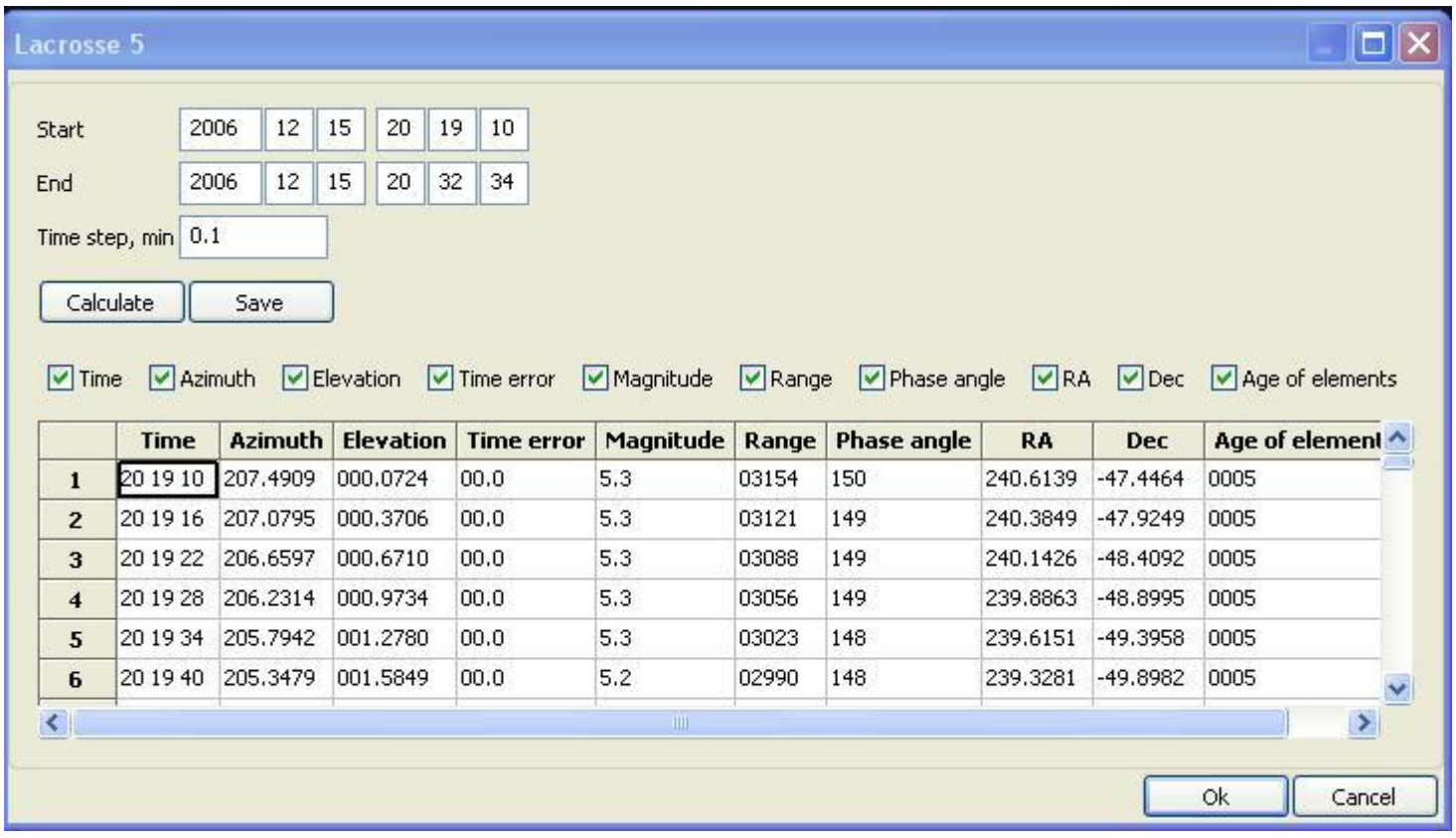
I have still to examine this option and how to use it.

ı ephemeris.

Select **Ephemeris** and you will be shown rise and set times of the satellite. You are also asked what items you want shown as well as the **Time step** interval between successive predictions - use (say) 0.1 minutes



Press **Calculate** and ephemeris will be produced which you can save.



	Time	Azimuth	Elevation	Time error	Magnitude	Range	Phase angle	RA	Dec	Age of element
1	20 19 10	207.4909	000.0724	00.0	5.3	03154	150	240.6139	-47.4464	0005
2	20 19 16	207.0795	000.3706	00.0	5.3	03121	149	240.3849	-47.9249	0005
3	20 19 22	206.6597	000.6710	00.0	5.3	03088	149	240.1426	-48.4092	0005
4	20 19 28	206.2314	000.9734	00.0	5.3	03056	149	239.8863	-48.8995	0005
5	20 19 34	205.7942	001.2780	00.0	5.3	03023	148	239.6151	-49.3958	0005
6	20 19 40	205.3479	001.5849	00.0	5.2	02990	148	239.3281	-49.8982	0005

If you now click on **CHART** you will see all satellites above your horizon at the instant you chose for Lacrosse 5.

NOTE all the things you do in the main window (**SKY**) can also be done in the **CHART** window.

On the right hand side of the screen you will see a column of icons. These are all necessary for full use of the program

The icons in descending order do the following

- Zoom in - note how more stars become visible as field of view gets smaller
- Zoom out - opposite to the zoom in function

- Start time running - watch how the satellite/satellites move
- Advance time - so you can set your time to match the real time . Note the time is shown at top left of screen as well as in the taskbar at right bottom corner.
- Retard time - opposite effect of Advance time
- Set time
- Invoke the **Time Slider Mode**
- Show satellites - several options are available here - for example you can elect to display all satellites above horizon in your database at that instant - to show all- select Draw Satellite and then Click on All)
- Set field of view (binocular symbol)
- Lock on selected satellite (also unlock)
- Show trajectory (also don't show trajectory)
- Constellation lines (option of ON or OFF)
- Equatorial mount (instead of working in alt/az mode works in RA/Dec mode
- Flip vertical (or inverse)

- Flip horizontal (or inverse)
- Show RA/Dec grid (or don't show)
- Show az/el grid (or don't show)
- Measure angular distances on screen
- Guiding --- don't know what this does yet :-)))
- Options menu select (hammer symbol)

7.DROP-DOWN menus

Looking at the opening screen you will see the following line:

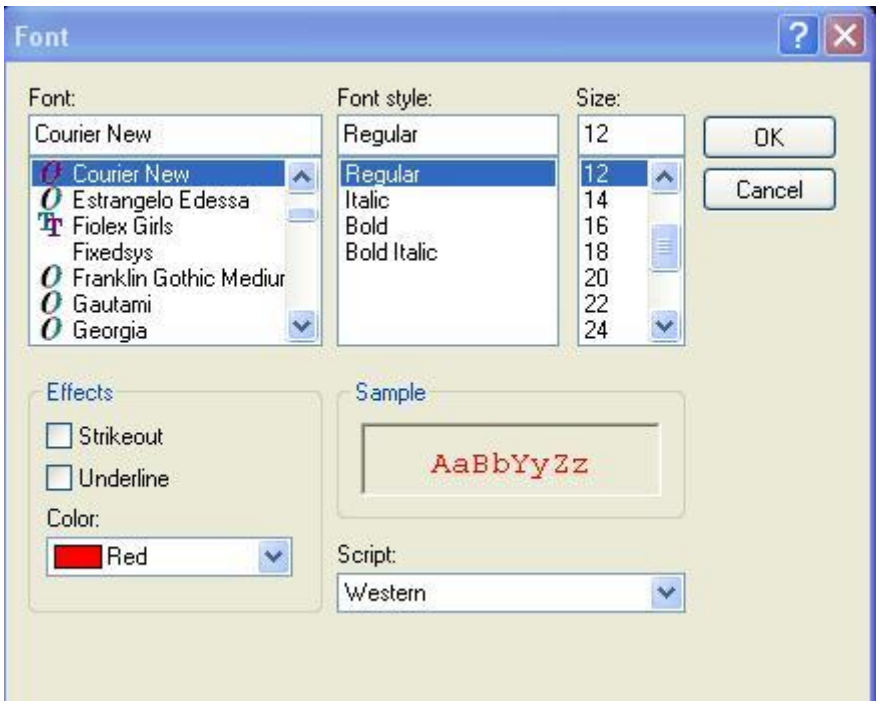
Dealing with each in turn:

COMMON

- Full Screen This enables you to set the full screen as your view window - the **DROP-DOWN** menu line will disappear. Either click on this option with the mouse or press F11. To **RETURN** to the original default view press F11 again.

- Night Vision To preserve your night vision you can either click on this option with your mouse or press CTRL-N. To return back to default view click with your mouse on this option or press CTRL-N again

- Set calculations window font This enables you to change fonts and colours used in your windows calculation section. Set up for what pleases you most.



- Set Sky/chart fonts. This is similar to the previous option so select what pleases you most.

- Options This was discussed earlier so will not be repeated. Note **Options** may also be selected from menu at right hand side screen (the **Hammer** icon.