# Satellite Tracker

## Sat.exe program v2.4.9 Oct 26, 2008
## Software Design and Development by Brent Boshart

### Yahoo Group Moderator - John Mahony (March 18, 2008)

## User Manual Version 0.0.8 Beta - September 14, 2009

**User's Manual by Larry McNish (rascweb42@yahoo.com),**
**with: Darwin Teague, and Oz**

**--- DISCLAIMER ---**

**THE SOFTWARE (SATELLITE TRACKER) AND THIS USER'S MANUAL ARE SUPPLIED "AS IS".**
**This manual is still under development and will be updated from time to time as new information becomes available after further testing of the software.**

**DANGER!**
**IT CAN BE QUITE EASY TO PERMANENTLY BLIND YOURSELF OR PERMANENTLY DAMAGE YOUR TELESCOPE AND/OR CAMERA EQUIPMENT USING THIS SYSTEM IF YOU DO NOT READ AND FOLLOW INSTRUCTIONS CAREFULLY, ESPECIALLY WITH REGARDS TO THE VARIOUS WARNINGS POSTED THROUGHOUT THIS DOCUMENT.**

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## Copyrights

# 1. Introduction

"**Satellite Tracker**", developed by **Brent Boshart**, is PC software for astronomical observers with specific computerized telescopes. This software can automate the finding and tracking (i.e. driving the telescope) to keep a satellite in the eyepiece of the telescope (or a camera).

**This program is not "SLAMWARE"**

**(You cannot just slam it into your computer and expect it to instantly work.)**

**Read this manual first.**

**There are many highly technical steps needed to accomplish satellite tracking and, if not followed properly, precisely, and in the correct sequence you will either:**

**a) not track the satellite across the sky as intended,**

**b) damage yourself, your telescope and/or your camera(s), or**

**c) both of the above.**

Before attempting to use this software to track satellites you should be capable of setting up your telescope, aligning it accurately, and using its various features to find and centre celestial objects in the eyepiece. Satellite Tracker will not do this for you, or compensate for an incorrectly aligned telescope.

Given current satellite orbital data parameters ("TLEs"), an accurate position on the Earth via GPS, and an accurate PC clock setting (date and time) the pointing and following accuracy of the software is highly accurate.

Many observing groups are using **Satellite Tracker** to observe the International Space Station (ISS), the Hubble Space Telescope and many other satellites as they pass over the observer's location.

Finally, just to clarify, Satellite Tracker will only point the telescope at "known" satellite locations. It does not "look" at the image of the sky as seen through a telescope and optically track a moving dot like a radar "gun sight".

**This software is no longer being actively developed. Current user support is from the peers in the Satellite Tracker Yahoo group.**

# 2. WARNINGS

**DANGER - Tracking satellites during daytime may cause your telescope to point at the Sun which can cause instant permanent blindness and/or permanent damage to your telescope and any attached equipment!**

**DANGER - Scope Movement Limits must be set before use to avoid damaging your telescope or its attached equipment. Tracking Limits - are in "Options, Preferences". See Section 10.6.1**

## 3. Satellite Tracker Yahoo Group

Yahoo Satellite Tracker Group formed Dec 30, 2000 when there were approximately, 3,000 users including freeware and registered users.

http://tech.groups.yahoo.com/group/satellitetracker/
May 2009 - 2254 members

This Yahoo group is a discussion board amongst members of the group using Satellite Tracker. Messages are the best way to communicate. **Uploading images and videos to the "Files" section of the group is preferred over embedding them in messages.**

To learn more about file sharing for this group, please visit http://help.yahoo.com/help/us/groups/files

# 4. PC Requirements

The performance of this software is dependant upon the PC being used and how busy it is performing other tasks.

The software calculates the selected satellite position many times per second, and sends commands to the attached telescope directing it to point at the appropriate spot in the sky. This is a continuous process since telescopes do not generally have speed and angle settings that match every orbiting satellite.

- In addition to the need for speed, the PC needs one or more "serial ports" to enable it to communicate with the telescope.

- A Joystick is useful for fine adjustments during tracking. A wireless joystick is best since it avoids tangling up the cable as you move around the telescope to observe.

- An internet connection is needed to download the latest satellite orbital element file(s) and the correct instantaneous time.

- If you intend on using a video camera to assist in making fine tracking adjustments, or capturing video images from the same PC that is doing the tracking, it should be a very fast PC. The video software (especially at high frame rates) may not leave enough processing time for Satellite Tracker to perform its high speed tracking.

# 5. Compatible Telescopes

Satellite Tracker supports the following computer-driven telescopes:
**TO BE DONE: CANVASS THE USERS for all makes/models and firmware versions that work in Continuous or Leap Frog mode. Ask for specific model numbers and controller firmware version numbers.**

| Telescope | Continuous Tracking** (or Leap Frog Tracking) | Leap Frog Tracking Only** |
|---|---|---|
| Meade LX200 and "compatible" | yes | -- |
| LX200GPS | yes | |
| ETX70-AT | | |
| AutoStar* 497 | No | Yes |
| Ultima 2000 | | |
| NexStar GPS | Yes | |
| Celestron CGE | yes | |
| AstroPhysics | | |
| Losmandy G11 mount | | |
| Losmandy-Gemini | | Yes with Firmware version L4V1.05 |
| Astrometric Skywalker II | | |
| Celestron CPC | Yes - use NexStar GPS | |

* Autostar - Meade's name for their hand controller

**Note** - ensure you have the latest versions of the telescope motor firmware and hand controller firmware. If not, follow your manufacturer's instructions on how to download and update the telescope software.

- The latest versions of Celestron NexStar controllers are documented at: http://www.nexstarsite.com/Firmware.htm

** "**Continuous Tracking**" is a slight misnomer. Satellite Tracker doesn't actually "track" satellites, it points your telescope at a precise point on the satellite track in the sky many times a second. It does not simply tell the telescope where to start and then what speed to use - this would not accomplish the desired outcome, because satellites do not follow the same path as stars across the sky. A telescope pointed at a spot in the sky and then told what speed to use would very quickly "track" in a different direction (East to West). Since the program to telescope communication is a very fast series of "GO HERE" commands, only those telescope mounts in the list above have been tested to work.

** "**Leap Frog Tracking**" is a method to aim at satellites - but not continuously. For telescopes that cannot be controlled accurately at high command speeds, the software will reposition the telescope ahead of the satellite periodically, i.e. "leap frogging" over it, then resting to allow viewing.

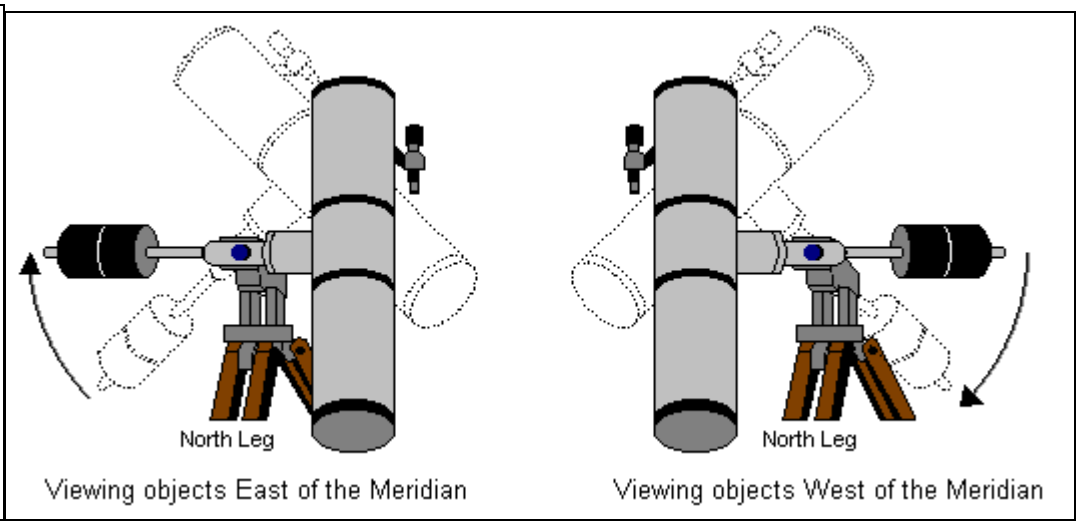
Sat Tracker guides an LX200 classic by sending a rapid sequence of gotos. It guides an LX200GPS/R/ACF by adjusting the slew speed. I'm not sure what it does with various Celestron models. -John

# 6. Equatorial, Fork and Wedge Mounts

## *6.1 Equatorial mounts*

Equatorial Mounts - have problems tracking a satellite:

- when it crosses the North-South meridian line - the mount may stop, flip the entire telescope tube over, then continue
- when it is near the North/South Celestial Pole where slight changes in sky position are interpreted as large changes in Right Ascension (and Declination) and the scope takes a lot of time to reposition itself



## *6.2 Alt-Az (Fork) mounts*

Alt-Az (Fork) mounts - have problems tracking a satellite:

- when it's directly overhead since the telescope has to pause, rotate in azimuth 180 degrees then continue following down to the other horizon. Otherwise the scope tube and everything it is carrying would end up "upside down".

Starting at the horizon (left picture) and tracking upwards through the Zenith . . .

the scope would go "upside down" and may crash the eyepiece and everything else mounted on its back into the base of the fork mount if "slew limits" are not set properly in the software (and scope) beforehand.

With appropriate "slew limits" the scope should pause, rotate 180 degrees in azimuth, then continue down towards the other horizon.
During the azimuth rotation, the scope cannot "follow" the satellite - it has to "catch up" later.

## *6.3 Alt-Az (Fork) mounts on a "wedge"*

Alt-Az (Fork) mounts on a "wedge" to make them Equatorial:

- probably the best solution - works well except that it has problems tracking a satellite that is near the Celestial Pole (for the same reason as an equatorially mounted scope).

# 7. TLEs

Satellite orbits are described mathematically in a standard notation known as TLE - Two Line Elements. The series of numbers in each TLE describes the orbital height and the three dimensional orientation of the orbit around the Earth. It is these numbers that allow Satellite Tracker to point the telescope at the target. If they are wrong, the target will not appear in the centre of the eyepiece or camera.

"Stale" TLEs are the easiest way to miss a satellite, and also the easiest thing to fix. Just download a new set of TLEs from within the Satellite Tracker program and away you go.

**Note** - Nominal timing degradation for each day lateness in the TLE is 3 seconds. That is, if TLE is 3 days old, expect 9 seconds timing error in the offsets. We once found a nominal 20 second error in a 4 day old TLE for ISS tracking. (See the section on Tracking the ISS)

## *7.1 Updating TLEs*

However, the primary source for TLEs - http://www.space-track.org/perl/login.pl - needs to know why people want this information before handing it out. Registering is simple and easy, and within a day or two your request to register will be processed. You will be issued a userid and password for the download site and this must be used in order to get the TLEs.

### 7.1.1 visual.tle

- 216 satellite records (May 2009) including ISS (ZARYA), HST, COBE, IRAS, and many "R/B" - rocket boosters

### 7.1.2 iridium.tle

- 90 satellite records (May 2009) - all Iridium satellites

### 7.1.3 sp_Interest.tle

- 42 satellite records (May 2009) including ISS (ZARYA), HST, COBE, IRAS and others

### 7.1.4 full_catalog.tle

- 13,079 satellites (May 2009)

**Heavens-Above.com** has convenient links for the following satellites (shown with their TLE name, USSPACECOM Catalog No. and the TLE file(s) that contains the pass information:

| Satellite | TLE name | CATALOG | TLE File |
|---|---|---|---|
| ISS | ISS (ZARYA) | 25544 | visual, sp_interest, full_catalog |
| Genesis I | GENESIS 1 | 29252 | full_catalog |
| Genesis II | GENESIS 2 | 31789 | full_catalog |
| Envisat | ENVISAT | 27386 | full_catalog |
| Iridium Flares | IRIDIUM ## (many) | many | iridium, full_catalog |

Space-track also lets you make your own custom Favorites list with just the satellites you want.

Here is a list of "favorites" from other users (see below)

00005 00029 06173 12504 16908 20580 20667 24836 24841 24842 24870
24871 24873 24967 25043 25078 25105 25319 25320 25344 25527 25544 33340

Space Track will accept multiple entries separated by spaces. Cut and paste the above lines into Space Track's "Configure My Favorites" and submit all at one time.

Then copy and paste the TLE section from your Space Track's "My Favorites Page" into Notepad, save as favorites.txt in the Satellite Tracker directory, then load it into Satellite Tracker.

| Catalog Number | Common Name | International Designator | Comments |
|---|---|---|---|
| 00005 | Vanguard 1 | 1958-002B | The oldest man-made satellite still in orbit. |
| 00029 | Tiros 1 | 1960-002B | First weather satellite |
| 06173 | Triad 1 | 1972-069A | Nuclear powered satellite may still be transmitting.<br>Used for ionospheric research by the Navy. |
| 12504 | COSMOS 1275 | 1981-053A | Dead tumbler |
| 16908 | EGP (AJISAI) | 1986-061A | (EGS "Ajisai" today, a recent name change)<br>Favorite Flasher (see other flashers below)<br>EGP - Experimental Geodetic Payload<br>EGS - Experimental Geodetic Satellite<br>AJISAI - The Japanese name for the Hydrangea plant/Flower |
| 20580 | HST | 1990-037B | Hubble Space Telescope |
| 20667 | INTELSAT 604 | 1990-056A | ~5sec 10Mag Geo Sat Flasher |
| 24836 | IRIDIUM 914 | 1997-030A | tumbler |
| 24841 | IRIDIUM 16 | 1997-030F | tumbler |
| 24842 | IRIDIUM 911 | 1997-030G | tumbler |
| 24870 | IRIDIUM 17 | 1997-034B | tumbler |
| 24871 | IRIDIUM 920 | 1997-034C | tumbler |
| 24873 | IRIDIUM 921 | 1997-034E | tumbler |
| 24967 | IRIDIUM 36 | 1997-056C | tumbler |
| 25043 | IRIDIUM 38 | 1997-069E | tumbler |
| 25078 | IRIDIUM 44 | 1997-077B | tumbler |
| 25105 | IRIDIUM 24 | 1997-082B | tumbler |
| 25319 | IRIDIUM 69 | 1998-026A | tumbler |
| 25320 | IRIDIUM 71 | 1998-026B | tumbler |
| 25344 | IRIDIUM 73 | 1998-032C | tumbler |
| 25527 | IRIDIUM 2 | 1998-066A | tumbler |
| 25544 | ISS (ZARYA) | 1998-067A | International Space Station |
| 33340 | Progress-M65 | 2008-043A | Supply ship soon to decay |

**ALSO** - (from Oz) - There are 8 geodetic satellites (http://en.wikipedia.org/wiki/Satellite_geodesy ) that I know of, here is the list:

| | | | |
|---|---|---|---|
| EGP | 16908 | (by far the best) | (It actually photographs better in Leap Frog since in full tracking it looks like a slow strobe light) |
| Grace 1 | 27391 | Grace 2 | 27392 |
| Lageos 1 | 8820 | Lageos 2 | 22195 |
| Stella | 22824 | | |
| Westpac | 25398, | | |
| Sratlette | 7646 | | |

**ALSO** - Darwin Teague's list of "favorite" satellites (perigees under 400 km and inclinations over 40 degrees) can be found at http://www.darwinsastroworld.com/myfavorites.htm ("7338. COSMOS 660's rocket body is pretty bright")

## *7.2 Other Sources for TLEs*

If, for some reason, you do not register on space-track.org to get the TLEs, then secondary copies of these files can be found at the following locations: (It is beyond the scope of this document to describe how to register on the following sites or how to use them.)

- http://www.celestrak.com/NORAD/elements/visual.txt - has very bright objects that are visible with the naked eye.
- http://www.heavens-above.com - page: ISS Visible Passes, Link: Orbit
- http://www.calsky.com
- http://spaceflight.nasa.gov/realdata/sightings/SSapplications/Post/JavaSSOP/orbit/ISS/SVPOST.html
- One user reports that he has been using Satellite Tracker for a few years now and the built in TLE downloading is sometimes a little flakey. He suggests you go to: http://celestrak.com/SpaceTrack/TLERetrieverHelp.asp and download the program "Space Track TLE Retriever" program (it is a blue link "Version 1.5.8"), Once setup, its 2 clicks and all the TLE sets that you selected are downloaded and uncompressed every time.

# 8. Setting The Time in all the Right Places

Having the correct time on the PC running Satellite Tracker is imperative. Since many satellites orbit very quickly, even a small inaccuracy in time can lead to a missed opportunity.

The best way to set the time on a PC is via an "Internet Time Server" or, failing that, a GPS unit interfaced to the PC that has been tested to produce accurate time information (apparently some GPS units do not report the accurate time through their communications port). The objective is to get the time correct to within 50 milliseconds of "atomic time" before a particular satellite pass. You may also want to check your PC clock "drift" Some PC hardware clocks are known to drift several seconds in just a couple of hours. This is enough to "miss" a satellite pass later in the observing session.

Windows XP and Vista can be set to periodically verify the hardware computer clock against an internet time standard, but this may not be often enough or accurate enough for Satellite Tracker. You can also command Windows to resynchronize the clock in the Date/Time applet.

Another source of Internet Time signals is Nistime - http://tf.nist.gov/service/its.htm - which provides software to set the PC clock accurately.

Once you have a method of updating the date and time on the PC, the next thing to look at is setting the correct date and time on the telescope. The date and time on a computerized telescope is used in a few different ways. First, it is used to limit the selection of alignment stars to those high enough above the horizon to offer good alignment. Second, it is used to prevent targeting objects that are below the horizon. Third, some telescopes calculate the apparent position of an object including atmospheric refraction as it gets closer to the horizon, and point to the apparent position rather than the celestial coordinates. If the time is wrong, these database searches and slewing to objects near the horizon will be incorrect. However, the telescope time does not need to be set within milliseconds of "atomic time".

Finally, ensure that any digital cameras you are using also have the correct date and time so that you can correlate them to your observing log.

And don’t forget about Daylight Saving Time starting and ending - this means you have to reset the clocks in your all PCs, telescopes and cameras.

## *8.1 Setting the Time on a Meade LX200 from the PC*

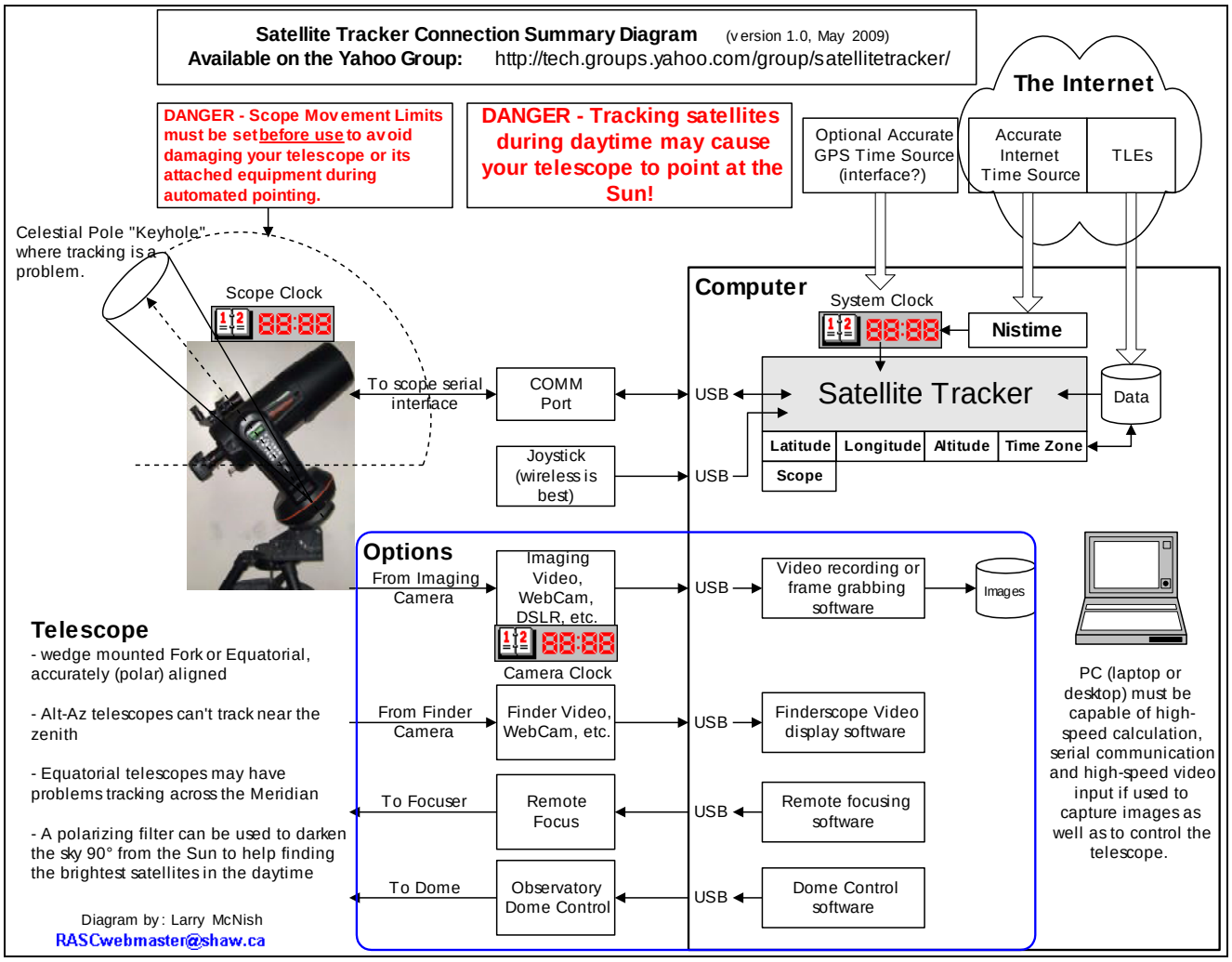
See Section 10.1 below.

# 9. Getting Started

**The steps below are just a summary of what you will go through to get the software working. The complete description of all these steps is in the next section.**

- Download and install the **Satellite Tracker** software onto your computer
- **NOTE** - the latest version of the program involves two distinct installation steps:
  - 1. download and run "setup.exe" (dated March 14, 2008) from the Yahoo Group "Files" section which installs version 2.4.8
  - 2. download "SAT.EXE" (dated October 26, 2008) from the Yahoo Group "Files" section then copy it to the installation directory where version 2.4.8 was installed replacing that version's executable with version 2.4.9
- Set your PC to the accurate date and time - e.g. use an internet time service
- Determine the accurate position and elevation of your telescope
- Tell the software about your scope location
- Locate a source of TLEs - e.g. registering to use space-track.org and get a new version
- Align your finderscope and telescope to the Celestial Sphere and focused properly
- Set Scope Limits to avoid damaging your telescope and attached equipment
- Tell the software what kind of scope you have
- Connect everything together
- Start testing the system

## *9.1 How Everything Connects:*



My NexStar 8 GPS scope with piggyback DSLR camera and mobile power pack connected to my laptop through a USB Serial adapter and a long serial cord to the hand controller connector.

The long cord is needed to ensure it does not cause a problem if it wraps around the scope when tracking multiple satellites around the sky.

The wireless joystick can be seen resting on the laptop keyboard. Having one less wire to worry about is a good thing if there is also a video or webcam (and cable) in place of the eyepiece.

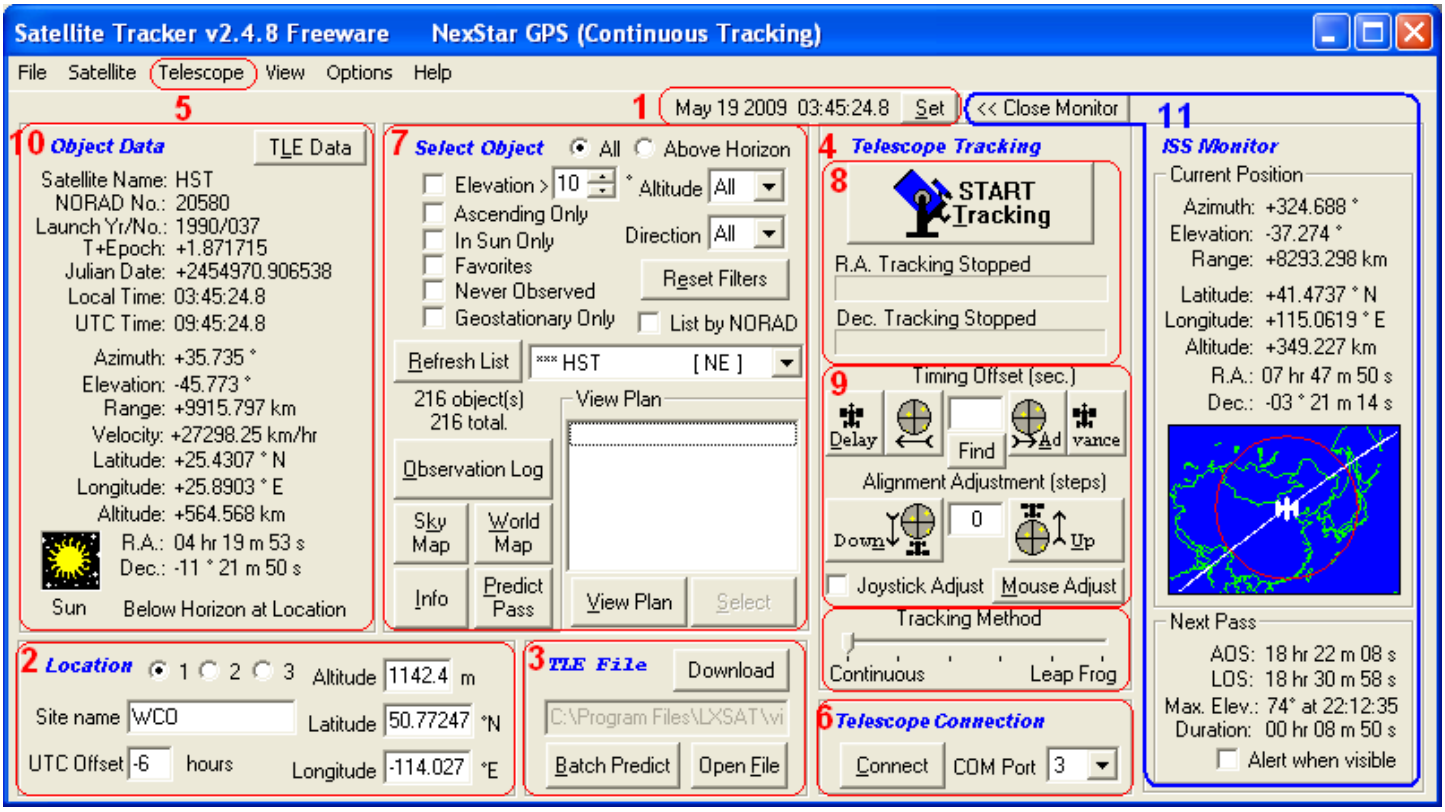
Tip: When setting up to track the ISS across the sky, practice with other satellites before the event to ensure everything is working properly.

How I hold my wireless joystick next to the finder scope to keep the satellite in the centre of the crosshairs.

Other reasons to do a "dry run" before a satellite pass is to note the path of the scope. It helps to know when you will need a stool to reach the finder, when your neck will be twisted around to see the finder, when/if the scope will pass close to or under Polaris, or if the camera will hit the mount, etc.

It also helps to make sure you haven't forgotten something or made a mistake, like forgetting to connect and select the joystick, leaving the location set from your last star party, having a misaligned finderscope or having the focus set for another eyepiece.

# 10. Satellite Tracker User Interface

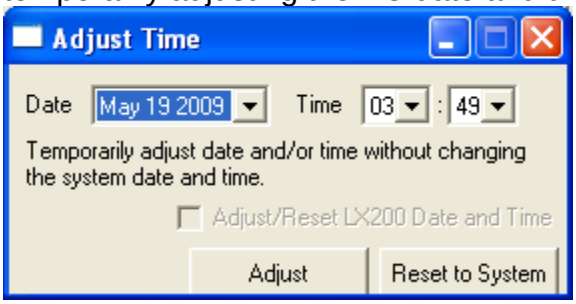



**The numbered sections in the image above refer to the sections in the process outlined below**

## *10.1 Set the PC Date and Time Accurately*

**IMPORTANT**: Time is critical. Ensure your computer's date/time setting is accurate to a fraction of a second if possible. Various software is available on the Internet for accurate adjustment of your clock.

- The Time entry and displays are in 24 hour format.
- To allow planning for future satellite passes, clicking **Set** will open a dialog box to allow temporarily adjusting the PC date and time without setting the "System Time" on the PC.




- This dialog box also allows setting the date and time on a Meade LX200 telescope if the scope is connected.

## *10.2. Enter Location Parameters*

Up to three separate locations can be defined.

**IMPORTANT**: Accurate (high precision) observing sight information is critical, especially if you are observing the conjunction of a satellite with the Moon or other object. To determine your location, use a GPS reading, a very accurate map, Google maps, or Google Earth.

Latitude and Longitude must be entered in decimal degrees e.g. 42.333333. To convert from degrees, minutes and seconds the formula is ( (seconds/60) + minutes )/60) + degrees.

- Click a **Location** option button to define location 1, 2 or 3.
- In the **Site name** text box enter a location description of your choice.
- In the **UTC Offset** text box, enter the time difference in hours from Universal Coordinated Time (UTC ) or also called Greenwich Mean Time (GMT). Be sure to include adjustments for day light saving time when applicable. For instance, Eastern Standard Time would be -5 and Eastern Daylight Savings Time would be -4.
- Enter your **Altitude** in meters.
- Enter your **Latitude** as accurately as possible as degrees (and decimal points of a degree.) For example a latitude of 43 degrees and 42 minutes would be entered as 43.7 (i.e. 43+(42/60)). A southern latitude should be entered as a negative value. Latitude can be read off a map or more accurately from a GPS unit.
- Enter your **Longitude** as accurately as possible as degrees (and decimal points of a degree.). A western longitude (e.g. North and South America) must be entered as a negative value. Do not enter a longitude greater than 180 or less than -180.
- Note - the program remembers last location that was in use when it is started.

## *10.3. Load a TLE File*

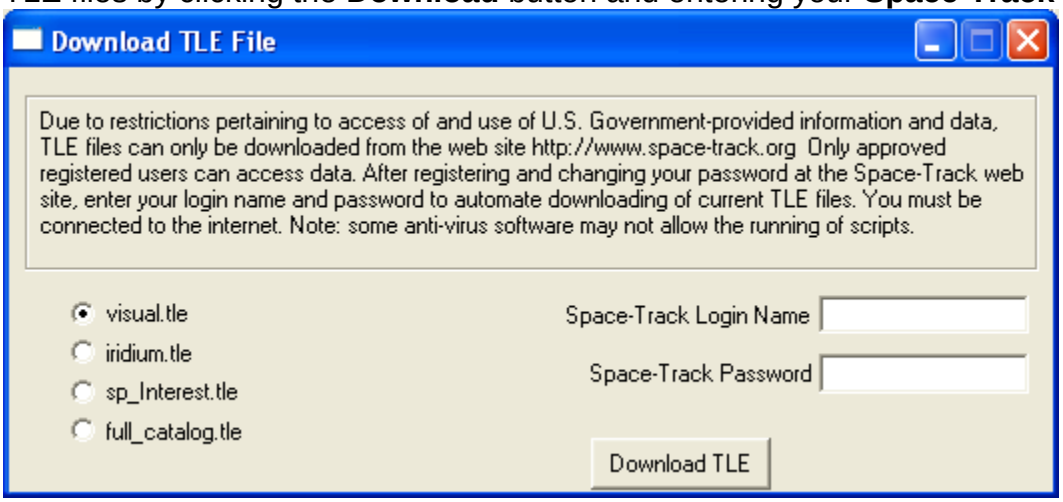
The NASA/NORAD 2 Line Element (TLE) files contain parameters describing the orbit of satellites. They are needed for the program to calculate satellite positions.

**IMPORTANT**: Having current TLEs is critical. To avoid accidentally choosing the obsolete TLE file which was included with the download, delete it once you have downloaded a newer version:

- Click Open File in the TLE File section of the UI
- Select the visual.txt file by right clicking it
- then select Delete

- Always use the newest TLE file possible.
- Files can be downloaded from http://www.space-track.org

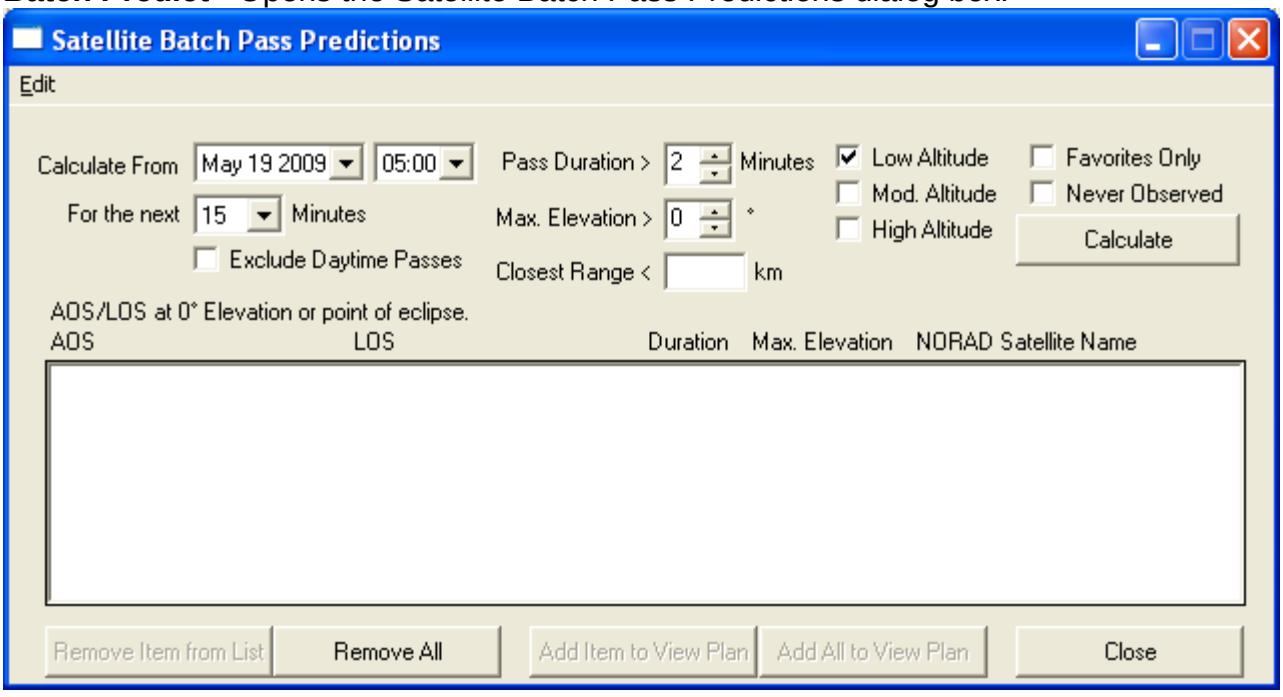
- Once registered at Space Track, you can use Satellite Tracker to automatically retrieve current TLE files by clicking the **Download** button and entering your **Space-Track login**.




- The four different TLE files are documented in the section "**Updating TLEs**" above. Unfortunately Satellite Tracker doesn't allow for a selection item of "favorites" in the download dialog. If you create one and download it yourself, you can still select it on the Open dialog.
- Download new files daily if possible. Use of older files will lead to inaccurate results.
- Note: The visual.txt TLE file in your original download is very outdated and is for the demonstration of program functionality only!
- To load a file, click the **Open File** button to open the directory of downloaded TLE files. Files usually are of type ".TLE" but may also be of type ".TXT". Select the file you want.
- Once a file is opened, the total number of objects in the file will be shown below the **Refresh List** button in section **7**

### 10.3.1 Satellite Batch Pass Predictions

- **Batch Predict** - Opens the Satellite Batch Pass Predictions dialog box:



- **Satellite Batch Pass Predictions** to predict passes for an entire TLE file

- **Calculate From** - date/time - allows a starting date selection of any date from today's date for a month, and any starting time from 00:00 hours to 23:30 hours in half hour increments
- **For the nex**t - allows a time interval from the starting date/time from 15 to 300 minutes (5 hrs)
- **Exclude Daytime Passes** - check this box to eliminate daytime passes (i.e. include only nighttime passes) - See the WARNING about daytime passes and inadvertently pointing your telescope at the Sun.
- **Pass Duration >** - allows "filtering" the selections to only those satellites where the pass will last longer than 2 minutes (up to longer than 10 minutes)
- **Max Elevation >** - allows "filtering" the selections to only those satellites where the pass will achieve an altitude above the virtual horizon higher than the number of degrees chosen - very useful for people whose observing sites are surrounded by obstructions.
- **Closest Range <** - allows "filtering" the selections to only those satellites where the pass will be within the number of kilometers of the observer - i.e. "close passes" which are usually brighter (but faster)
- **Low Altitude** - **TO BE DONE - the exact altitude used is unknown at this time**
- **Mod. Altitude** - **TO BE DONE- the exact altitude used is unknown at this time**
- **High Altitude** - **TO BE DONE- the exact altitude used is unknown at this time**
- **Favorites Only** - allows "filtering" the selections to only those satellites previously marked as "favorites" in your **Observing Log**
- **Never Observed** - allows "filtering" the selections to only those satellites in the list that do not appear in your existing **Observing Log**
- **Calculate** - performs the calculations for all satellites in the TLE file that pass the various "filters" set above. NOTE - this can take some time to do on your PC, especially for the full_catalog TLE file. If it results in NO calculated passes - ensure you set the filters correctly (such as at ensuring that at least one of Low, Mod. or High Altitude is checked)
- **List of Predictions** -
    - **AOS/LOS at 0° Elevation or point of eclipse** - the title of the text box
    - **AOS** - **TO BE DONE** - the date, time, and direction of the beginning of the pass - AOS and LOS may refer to rising/setting or the altitude you set under preferences for altitude of AOS or LOS, but it may also refer to coming out of or going into the Earth's shadow while the satellite is above the horizon (unless you tell ST to ignore this).
    - **LOS** - **TO BE DONE** - the date, time, and direction of the end of the pass - AOS and LOS may refer to rising/setting or the altitude you set under preferences for altitude of AOS or LOS, but it may also refer to coming out of or going into the Earth's shadow while the satellite is above the horizon (unless you tell ST to ignore this).
    - **Duration** - the pass duration in hh:mm:ss
    - **Max. Elevation** (and time) - the maximum height the satellite will achieve above the horizon during the pass in degrees altitude and at what time that will happen
    - **NORAD** - the satellite catalog number
    - **Satellite Name** - the NORAD Satellite Name
- **Remove Item from List** - select a listed pass and click this button to remove just that satellite pass from the list
- **Remove All** - clears the list in preparation for a new calculation
- **Add Item to View Plan** - select a listed pass and click this button to add that satellite pass to the **View Plan**
- **Add All to View Plan** - adds all remaining items in the list to the **View Plan** and then clears the list

- **Close** - closes the dialog box
- **Edit** (menu item) **Copy** - select a listed pass and click this to copy the information to the Windows Clipboard as text
-

## *10.4 Align the Telescope*

**IMPORTANT** - Ensure your finderscope is aligned exactly with the main telescope.

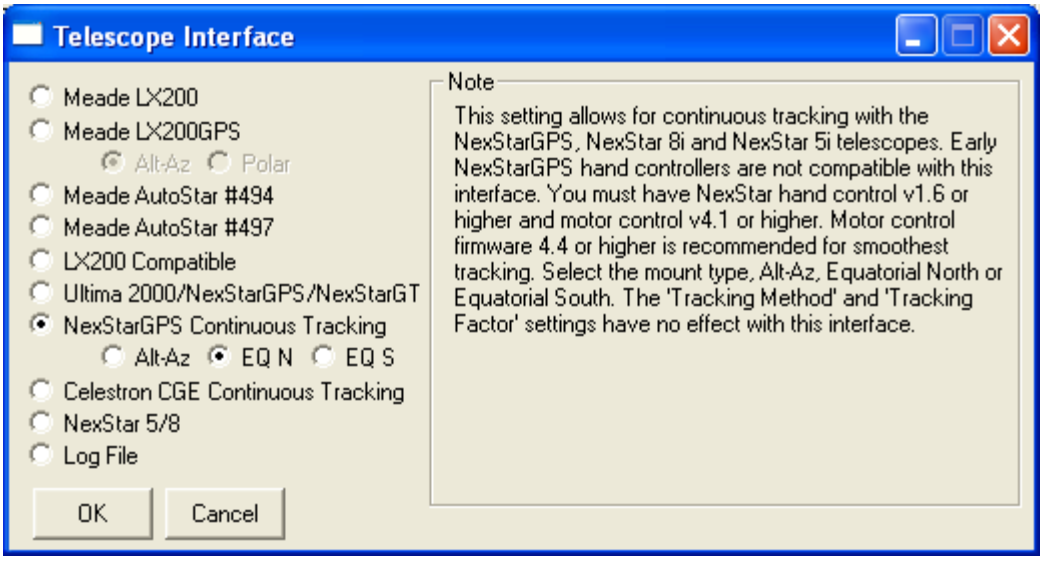
**IMPORTANT** - An accurate 2-star or 3-star alignment of the telescope should be performed.

- Use the procedure defined in your telescope's Owner's Manual to perform a sky alignment.
- Ensure that the alignment stars are centered in a high power eyepiece and focused properly for best results
- Also ensure the alignment is carried out with all equipment attached to the telescope that will be used during the observation run - adding equipment weight after the telescope is aligned can cause misalignment.
- If you can't do a 2-star or 3-star alignment, then do 1 star, but in this case pick a star in the quadrant where the satellite will pass
- Verify your alignment repeatedly between overpasses - check targeting other stars, planets, the Moon, etc. and adjust r realign if necessary
- Note - Satellite Tracker will be telling your telescope where to point several hundreds or thousands of times during a satellite pass. If the alignment is off, the tracking will be off. It's harder to adjust left and right than forward and backward in the line of travel. If the alignment is off, you'll be adjusting both all of the way through the pass. You will probably have to adjust Satellite Tracker during a satellite pass, but the better the alignment, the easier it will be to do.

## *10.5 Telescope Definition - Interface Protocol*

Click the **Telescope** item on the menu bar and select **Interface Protocol**


This brings up the Telescope Interface dialog box:




- In the 'Telescope'-'Interface Protocol' menu option, choose **Meade LX200** for LX200 scopes only as it makes extensive use of the Meade LX200 interface. Protocol. To optimize continuous tracking for this telescope, adjust the Tracking Factor in menu option Options-Preferences.

- **Meade LX200GPS** - This setting allows for continuous tracking with the Meade LX200GPS telescope. Firmware version 1.5c or later is required. For "Leap Frog" tracking use the Autostar 497 interface setting. If the tripod is carefully leveled, tracking will be improved. Changes to the "Timing Offset" or "Alignment Adjustment" while tracking will take 5 to 10 seconds before taking effect. Remember, having your computer time set very accurately and a 'fresh' TLE file is critical. The "Tracking Method" and "Tracking Factor" settings have ne effect with this interface.

- **Meade AutoStar 494** - The AutoStar 494 which has slower RS232 communications is only capable of "leap frog" tracking. The "Tracking Method" setting has no effect. Alternatively, consider using menu option "Satellite - Create View Plan TLE File". Use the custom file by dragging it from Windows Explorer and dropping on the Satellite button of the Meade AutoStar Update Program. On the AutoStar, the object list will be in order of AOS. Satellite Tracker can be used to monitor their current position and the AutoStar to perform tracking when visible.

- **Meade AutoStar 497** - Use this setting for Meade AutoStar 495/497 telescopes. Only "Leap Frog" tracking is available through the RS232 interface. The "Tracking Method" setting adjusts the frequency of "leaps". Alternatively, consider using menu option "Satellite - Create View Plan TLE File". Use the custom file by dragging it from Windows Explorer and dropping on the Satellite button of the Meade AutoStar Update Program. On the AutoStar, the object list will be in order of AOS. Satellite Tracker can be used to monitor their current position and the AutoStar to perform tracking when visible.

- **AutoStar 495** users should select the AutoStar 497 setting. LX200GPS telescopes can use the AutoStar 497 interface for leap-frog tracking or the LX200GPS interface for continuous tracking.

- Note for **Meade AutoStar** users: Under menu option "Satellite" and "Create View Plan TLE File" a custom TLE file can be created and then downloaded to the AutoStar using the Meade

AutoStar Update program. Also consider adjusting the "AOS/LOS at ?? Elevation" setting in the Preferences to match the lowest visible elevation at your site.

- **LX200 Compatible** - Use this setting for non-LX200 telescope mounts that have a LX200 compatible interface protocol and use long format (high precision) coordinates such as Astro-Physics. This setting requires minimal LX200 interface commands. The LX200 Control features are not available. Depending on the mount and its processor speed, the continuous tracking settings may not function properly. Try adjusting the "Tracking Factor" in menu option "Options - Preferences".

- **Ultima 2000/NexStarGPS/NexStarGT** - Use this setting for the Celestron **Ultima 2000** and earlier firmware versions of NexStarGPS and NexStarGT telescopes which are only capable of 'leap frog' tracking through the RS232 interface. The "Tracking Method" setting adjusts the frequency of "leaps". When tracking with the NexStarGPS, set the "Tracking Method" to the far right ("Leap Frog").

- **NexStarGPS Continuous Tracking** - This setting allows for continuous tracking with the NexStarGPS, NexStar8i, and NexStar 5i telescopes. Early NexStarGPS hand controllers are not compatible with this interface protocol. You must have NexStar hand controller version 1.6 or higher and motor control version 4.1 or higher. Motor control firmware version 4.4 is recommended for smoothest tracking. Select the mount type, Alt-Az, Equatorial North, or Equatorial South. The "Tracking Method" and "Tracking Factor" settings have no effect with this interface. (Note: This interface is not compatible with the **NexStar 5/8** scopes. A beta version interface is available in the current release.)

- **Celestron CGE Continuous Tracking** - Use this setting for continuous tracking with Celestron CGE (Equatorial mounted) telescopes. Tracking is interrupted at the meridian allowing the mount to flip. The "Tracking Method" and "Tracking Factor" settings have no effect with this interface.

- **NexStar 5/8** - Use this setting with the NexStar 5/8 scopes. Only "Leap Frog" tracking is available through the RS232 interface. The "Tracking Method" setting adjusts the frequency of "leaps". Tracking must be turned off on the hand controller before attempting to track satellites.

- **Log File** - This setting will simulate tracking. It creates a position log file named "logxxxxx" (where "xxxxx" is the NORAD number of the object) when "start Tracking" is clicked. Note that the "Timing Offset" and "Alignment Adjustment" values will affect the values. There is no RS232 communication in this setting. Ability to simulate tracking without a scope and write coordinate data to a text file. Can also produce a text file of coordinates for an entire pass from the text version of the Viewing Plan.

- Celestron CPC scopes - Use 'NexstarGPS continuous tracking' telescope interface

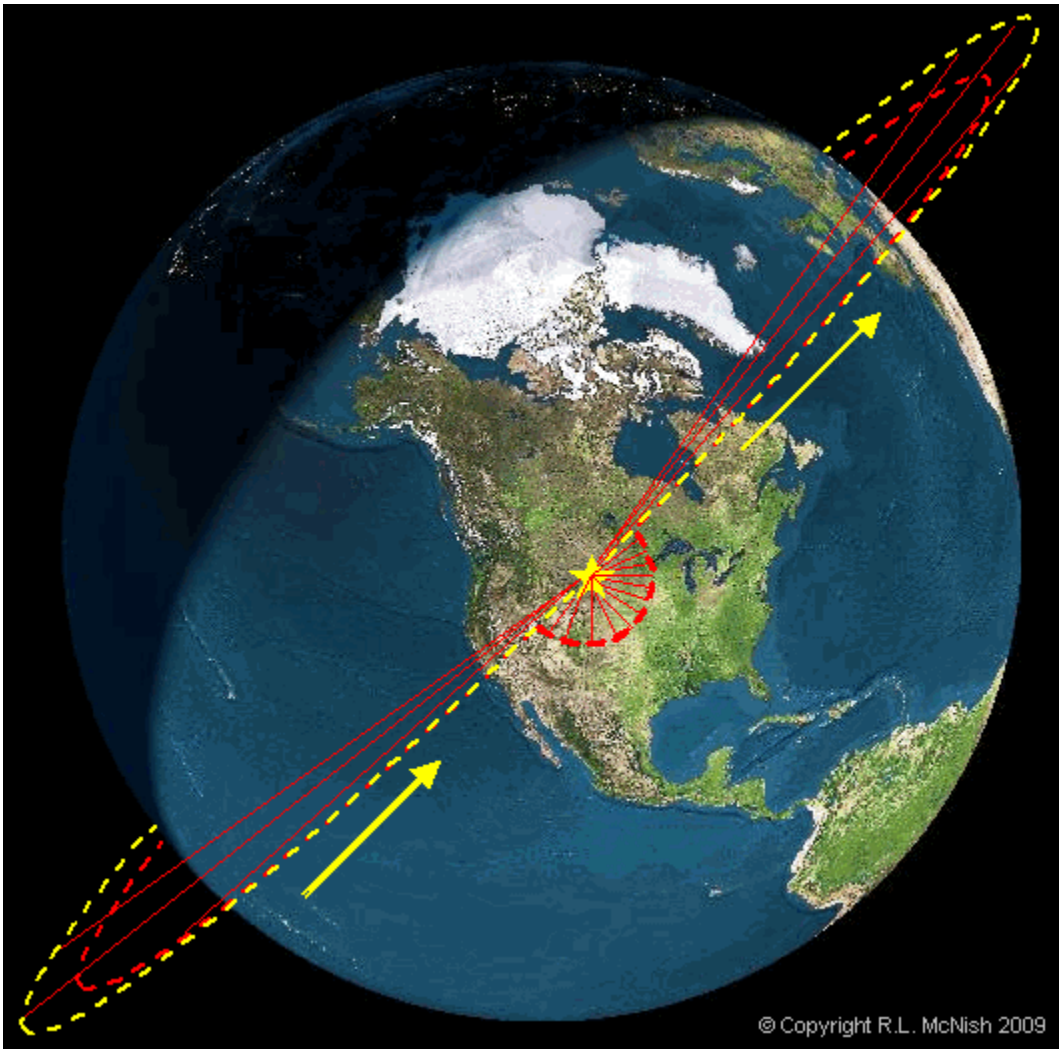
## *10.6 Connect to the Telescope*

**WARNING**

- **Before using any automated software to control a telescope, ensure that the telescope cannot damage itself or any attached equipment by entering "slew limits" into the telescope controller - see your owners manual.**
- **Satellite Tracker program tracking limits are in "Options, Preferences"**

### 10.6.1 Slew Limits

**Setting proper Slew Limits for an Alt-Az telescope will result in a targeting path such as the following:**




The Alt-Az telescope "tracks" the satellite rising from the horizon towards the local Zenith (red lines on left). As it nears the Zenith, this would cause the Alt-Az telescope tube to rotate until it was upside down! Instead, when the Slew Limits are set, it pauses, rotates 180 degrees around its base, then catches up to, and continues to "track" the satellite downwards towards the other horizon. Continuous visibility or imaging is not possible. **If not done, then the scope tube and everything it is carrying will tip over and crash into its base. SEE SECTION 6.2**

### 10.6.2 Physical Connection to the Telescope

- Using the proper telescope-to-PC cable, connect the RS232 serial communications port on the telescope to your computer's COM port.
- Physical COM ports on older laptops are usually labeled or defined COM 1, COM 2 etc.
- Newer laptops often do not have COM ports. In this case you will require a USB Serial Port adapter cable, its software "driver", and an available USB port. In these cases the COM ports are often defined as COM 3, COM 4 etc. These "USB-COM" interfaces are available from your telescope manufacturer or 3rd party supplier. Ensure your USB-Serial cable works properly with your PC and telescope before trying Satellite Tracker - i.e. try your manufacturer's telescope software first if possible. Some USB-Serial adapters are better than others.
- Once the telescope is connected, select the appropriate COM port in Satellite Tracker
- click the **Connect** button.

Note - If not connected and tracking is started - the program will attempt to automatically connect to the telescope.

This function verifies the communication connection to telescope. It also "autodetects" whether the telescope is capable of long format coordinates for improved tracking precision.

## *10.7 Selecting a Satellite*

From the large list of possible satellites, there are several ways to "filter" these results so that you don't choose a satellite that won't be visible, etc.

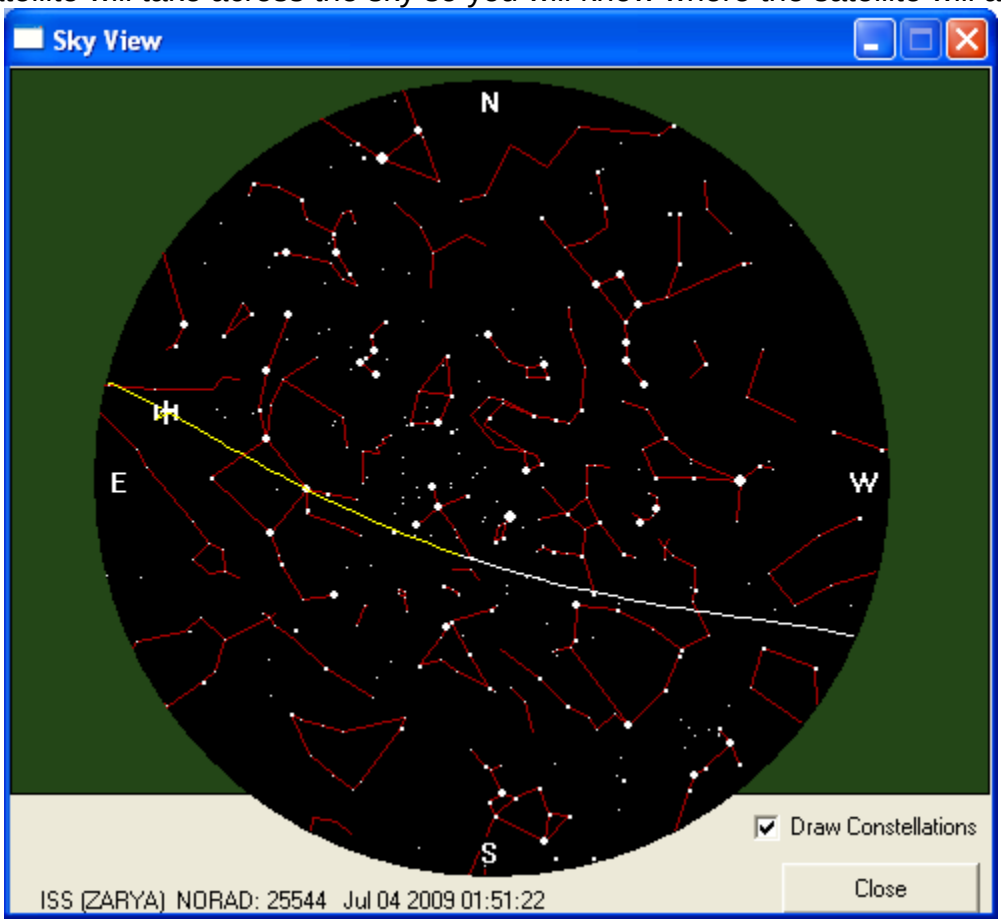
- **Filters**
  - **All** - no filtering of objects from the TLE list
  - **Above Horizon** - only show objects that are currently above the horizon at this location and time
  - **Other filters:**
    - **Elevation >** 0 to 90 degrees - only show objects above this elevation
    - **Ascending Only** - only show objects that are ascending from the horizon (getting higher). Satellites that are "descending" may not be in the sky long enough for you to acquire and track them
    - **In Sun Only** - only show objects that are above the horizon and in sunlight. Once a satellite enters the Earth's shadow it is extremely difficult to see
    - **Favorites** - filters to your favorites (as previously recorded in your **Observation Log**)
    - **Never Observed** - filters to objects you have not yet observed (as previously recorded in your **Observation Log**)
    - **Geostationary Only** - selects only geostationary satellites. Since these communications satellites orbit above a fixed point on the Earth, they do not

seem to move when observed from the ground, i.e. Satellite Tracker doesn't need to do much "tracking" only "pointing". This is most often used to visually identify groupings of geostationary satellites, or to take long-duration astrophotographs of the target area which will show the stars "trailing" trough the exposure, but the satellites as stationary "dots".

  - **Altitude** - All/Low/Mod/High - **TO BE DONE- the exact altitudes used is unknown at this time**
  - **Direction** - All/N/NE/E/SE/S/SW/W/NW - **TO BE DONE now? ascending?**
- **Reset Filters** - resets all filters to include all objects
- **List by NORAD** - display the object list as NORAD numbers and direction instead of Name and direction (don't forget to click Refresh List after checking or unchecking this option)
- **Refresh List** - regenerate the object list based on the filters and options described above
- **Satellite Selection Listbox** - shows a "short form" list of objects from the selected TLE file (Name and current direction) and allows one of them to be selected for tracking.
- **Info** - Information about the object if available in Satellite Tracker's Object Information Database.

### 10.7.1 Sky Map

- **Sky Map** - show a map of the sky (with the 900 brightest stars) and a line indicating the path the satellite will take across the sky so you will know where the satellite will appear

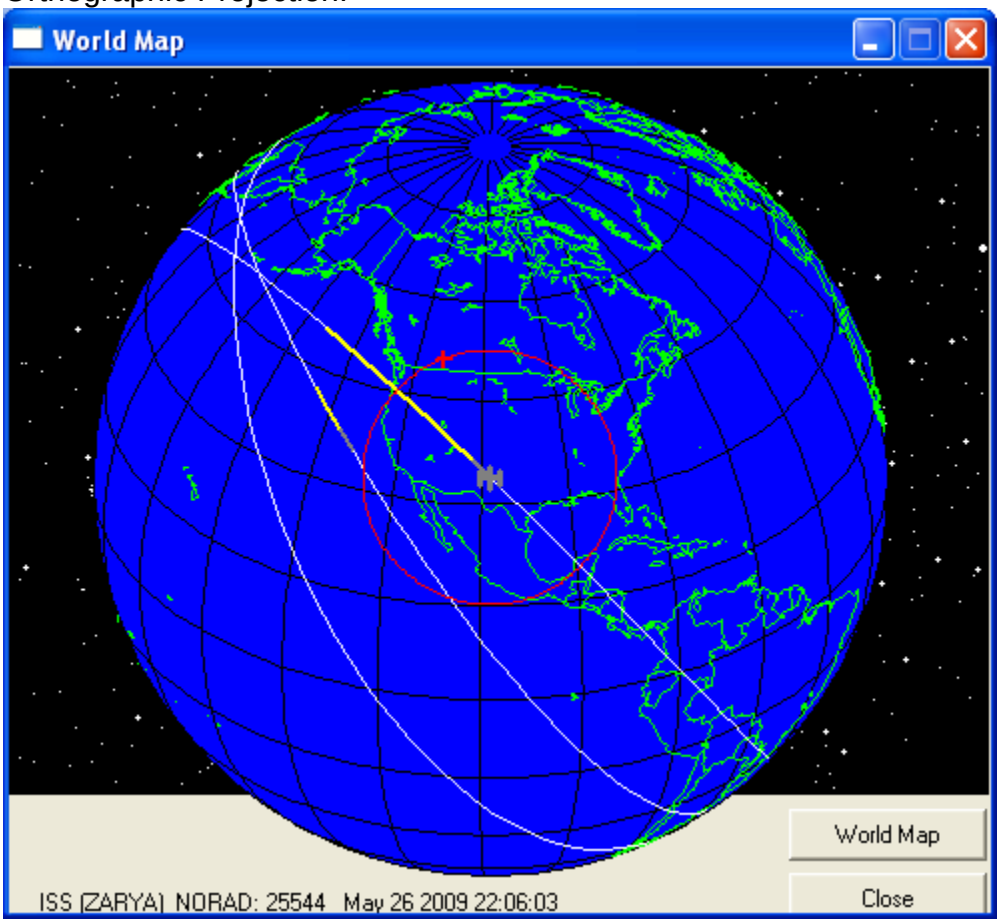



The sunlit portion of the track is plotted as a yellow line. At this time I do not know why it picks the transit time shown at the bottom, or why it plots the satellite icon where it does. The transit direction is not shown, but in the Northern Hemisphere the direction is generally eastward.

- **Draw Constellations** - if checked includes the common lines connecting the brightest stars in the constellations ("asterisms") to help identify the areas of the sky
- **Close** - closes the Sky view dialog box
- Maps only update once every 10 seconds.

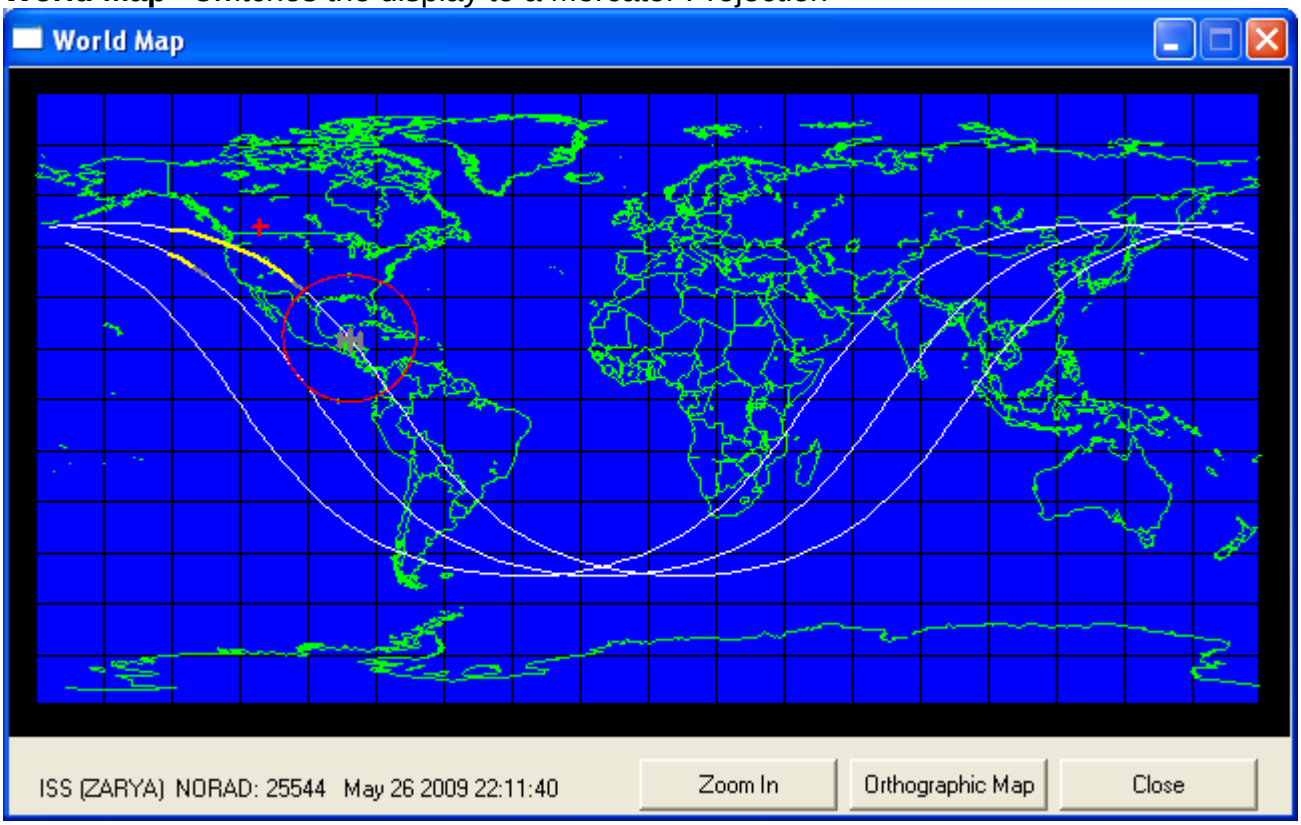
### 10.7.2 World Map

- **World Map** - displays either an Orthographic projection of the Earth
  - Orthographic Projection:




  - the current and next two satellite orbits are shown
  - the current position of the satellite is shown as an icon
  - the sunlit portion of the orbits are shown in yellow
  - the field of view of the satellite (and therefore the area of Earth's surface from which the satellite can currently be seen is shown as a red circle

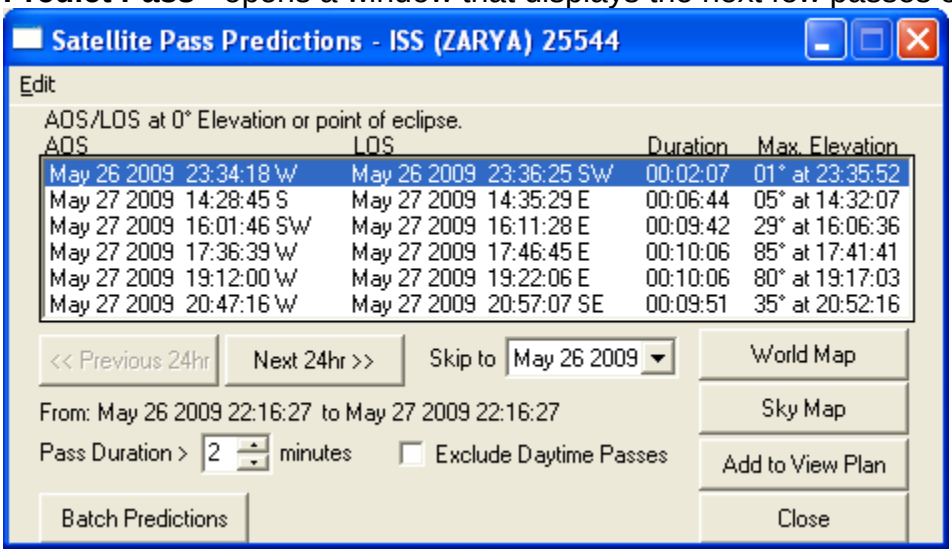
- **World Map** - switches the display to a Mercator Projection




- **Orthographic Map** - displays the Orthographic map shown above instead of the Mercator Projection
- **Zoom In** - enlarges the map display surrounding the current satellite position. Changes to **Zoom Out** to restore the full world display
- **Close** - closes the map display dialog box
- Maps only update once every 10 seconds.

### 10.7.3 Predict Pass

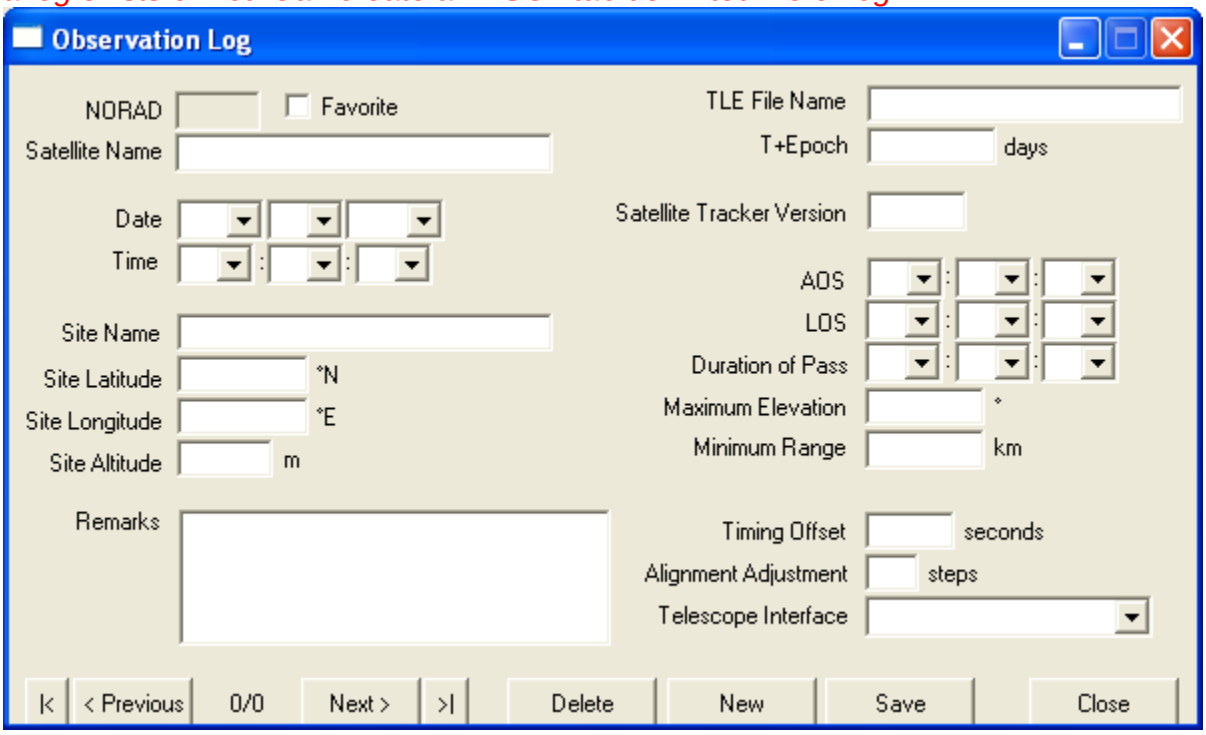
- **Predict Pass** - opens a window that displays the next few passes of the selected satellite




  - **AOS/LOS at 0° Elevation or point of eclipse** - the title of the text box
  - **AOS** - **TO BE DONE** - the date, time, and direction of the beginning of the pass
  - **LOS** - **TO BE DONE** - the date, time, and direction of the end of the pass
  - **Duration** - the pass duration in hh:mm:ss
  - **Max. Elevation** (and time) - the maximum height the satellite will achieve above the horizon during the pass in degrees altitude and at what time that will happen
  - **<< Previous 24hr** - go back one day
  - **Next 24hr >>** - go forward one day
  - **Skip to** (date) - choose a date in the future from the dropdown list
  - **Pass Duration >** - select a time duration from the dropdown list
  - **Exclude Daytime Passes** - if checked, only includes nighttime passes
  - **Batch Predictions** - opens the Satellite Batch Pass Predictions dialog - (see the section in this manual)
  - **World Map** - see above
  - **Sky Map** - see above
  - **Add to View Plan** - will add the selected event to your View Plan
  - **Edit** (menu item) - select a listed pass and click this to copy the information to the Windows Clipboard as text
  - **Close** - closes the Satellite Pass Predictions dialog box
  - Satellite Name - the NORAD Satellite Name and NORAD number appears in the window title.

### 10.7.4 The Observation Log

- **Observation Log** - You can record comments for each object. The "Favorite" checkbox can be used later for filtering. And the creation of an Observation Log record for a satellite also lets you use a filter of "Never Observed" to search for satellites not yet seen.
- *The "Stamp" button quickly records a sighting. The Observation Log Button indicates whether a log exists or not. Can create an ASCII tab delimited file of log* ???




  - **NORAD** - the NORAD number of the satellite
  - **Favorite** - check this box to identify this satellite as one of your "favorites" so that it can be used later as a "filter" to quickly select it from a long list of satellites in a TLE file
  - **Satellite Name** - the NORAD name of the satellite
  - **Date** - the date of observation
  - **Time** - the time of observation
  - **Site Name** - **most of the following are just settings that you have previously made**
  - **Site Latitude** -
  - **Site Longitude** -
  - **Site Altitude** -
  - **TLE File Name** -
  - **T+Epoch** -
  - **Satellite Tracker Version** -
  - **AOS** -
  - **LOS** -
  - **Duration of Pass** -
  - **Maximum Elevation** -
  - **Minimum Range** -
  - **Timing Offset** -
  - **Alignment Adjustment** -
  - **Telescope Interface** -

    - **Remarks** - a text box in which you can type your own comments such as "partly cloudy sky" etc.
    - **|<** - go to the first record in your Observation Log
    - **< Previous** - go to the preceding record in your Observation Log
    - **##/##** - the record number and number of records in your Observation Log
    - **Next >** - go to the next (following) record in your Observation Log
    - **>|** go to the last record in your Observation Log
    - **Delete** - delete the displayed record from your Observation Log
    - **New** - create a new record in your Observation Log with the information shown - you can usually just fill in "Remarks" to complete an entry
    - **Save** - save the Observation Log file
    - **Close** - close the Observation Log dialog box
- **View Plan** - Users can create a viewing plan ahead of time so important objects will not be missed. Objects are added to the plan using the "Predict Pass" dialog. When an object in the plan becomes visible a bold red font notifies the user. The user can select the object from the "Viewing Plan" dialog. "Remove after Selected" option in Viewing Plan Dialog. Objects are deleted out of view plan after being selected for tracking. Viewing Plan Dialog is enlarged. Function to delete all entries in Viewing Plan. New Viewing Plan Map graphically maps all objects in viewing plan. Ability to print View Plan or create tab delimited text file.
- **Select** - select the highlighted item in the View Plan listbox for pass calculation and tracking (double-clicking a satellite in the list box also causes it to be selected)
-

Various options are available to filter down available objects to view in the "Select Object" section. Try starting with "Low Altitudes", "Above Horizon", and "In Sun Only". Click the **Refresh Object List** button often (preferably each time before selecting an object).

Select an object from the "Object" combobox and click the [Start Tracking] button. Usually timing needs to be adjusted. Try adjusting from -5 to 5 seconds (by using the [Delay] and [Advance] buttons until the satellite comes into view. (Watch the eclipse/sun status, an eclipsed object will not be visible.)

NOTE: An alignment adjustment should be rarely needed. This adjustment may be needed if the telescope has not been accurately aligned or using higher magnifications. Because the degree of misalignment will vary along the path of the satellite the adjustment may need to be changed during tracking.

Version 1.1.8 and higher allow the user to adjust the Timing and Alignment using a joystick. Before each session make sure the joystick is properly calibrated (go to Windows Control Panel and Game Controllers). In Version 1.1.9 and higher, tracking can be started and stopped using the joystick trigger.

Tracking may also be adjusted using the mouse in a special mouse alignment dialog.

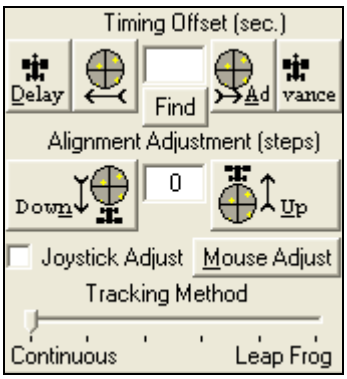
A viewing plan for the evening can be created by clicking the [Batch Predict] button in the 'TLE File' frame.

## *10.8 Start Tracking*

Click the **Start Tracking** button.

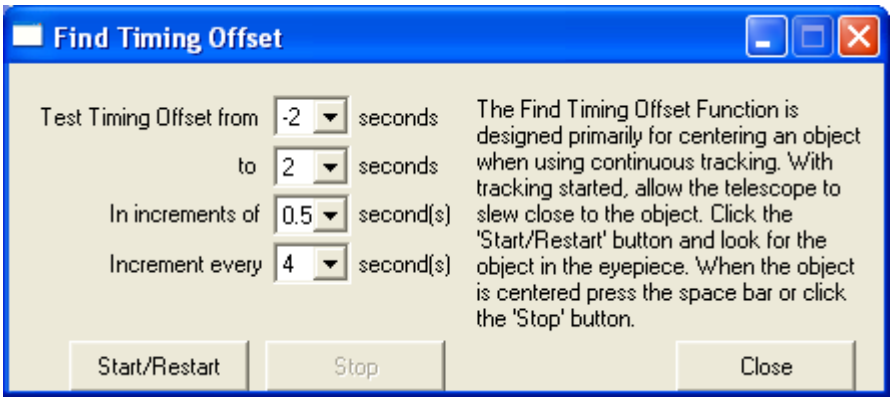
- If not connected and tracking is started the program will attempt to automatically connect to the telescope.
- If everything is working well and the satellite is above the horizon, the **R.A. Tracking** and **Dec. Tracking** boxes will continuously show the values at which the telescope is pointing.
- The Start Tracking button will change to **STOP Tracking**
- Or, you may get a dialog box indicating an error such as unable to communicate with the telescope (see Troubleshooting)

## *10.9 Adjustments while Tracking*

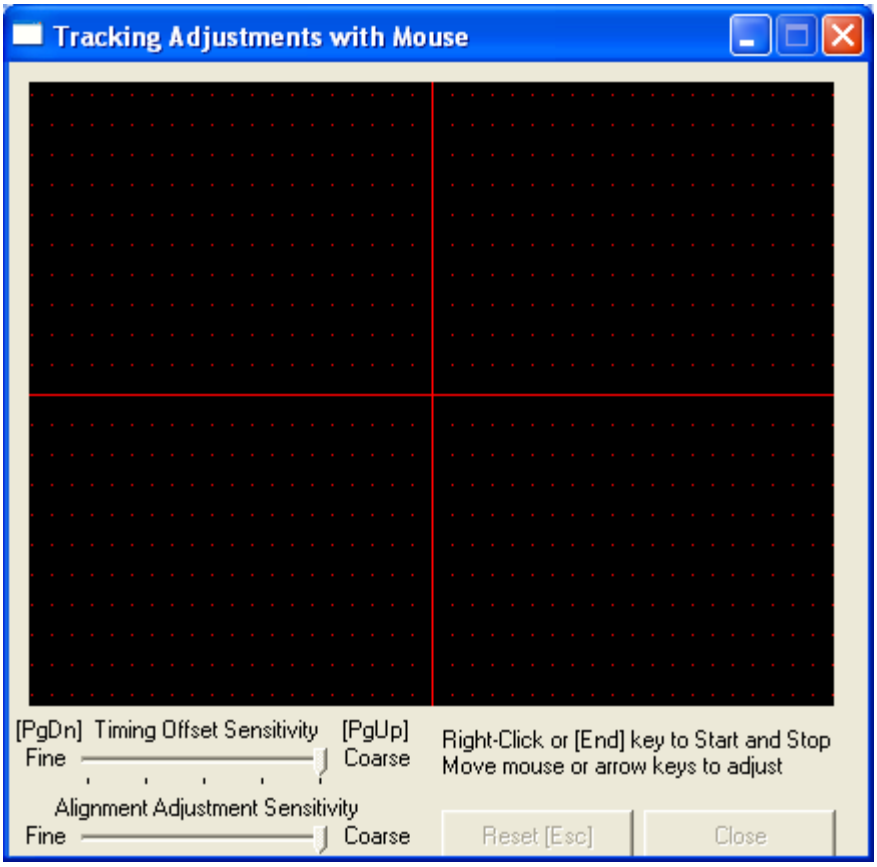



**TO BE DONE**

- **Timing Offset (sec.)** - the title for the number displayed just below
- **Delay** - Changes the timing by decreasing it according to the setting in Options… Preferences - Timing Offset Increments: Coarse
- **<-<** - Changes the timing by decreasing it according to the setting in Options… Preferences - Timing Offset Increments: Fine
- **Find** - This button brings up the following dialog box which is designed to assist in finding the proper timing offset for the pass in progress. It adjusts the timing of the telescope movements as described in the dialog box. When the satellite is centered perform the action indicated to set the timing values for the rest of the pass. Note - this changes only the timing portion of the telescope pointing - i.e. "along" the satellite track. If the Satellite is "left" or "right" of the track, this will not necessarily correct that offset.




- **>→** - Changes the timing by increasing it according to the setting in Options… Preferences - Timing Offset Increments: Fine
- **Advance** - Changes the timing by increasing it according to the setting in Options… Preferences - Timing Offset Increments: Coarse
- **Alignment Adjustment (steps)** - the title for the number displayed just below. (The Alignment Adjustment controls allow adjustment perpendicular to the path of the satellite.) NOTE: An alignment adjustment should only be needed if the telescope has not been accurately aligned or when using high magnifications. Because the degree of misalignment will vary along the path of the satellite the adjustment may need to be changed during tracking.
- **Down** - Changes the alignment by decreasing it according to the setting in Options… Preferences - Alignment Adjustment Increments
- **Up** - Changes the alignment by increasing it according to the setting in Options… Preferences - Alignment Adjustment Increments
- **Joystick Adjust** - check this box if you have a joystick connected to the PC and want to use it to control the adjustments to tracking during the pass
- **Tracking Method** - **Continuous to Leap Frog** - **TO BE DONE is it variable or just one or the other?**
- Mouse Adjust - click this button to bring up the Mouse Adjust dialog to allow using the Mouse on the PC to control the adjustments to tracking during the pass




- **TO BE DONE**
- A special dialog window opens for mouse adjustments(too much coding to be able to do it from any dialog), a right click will start and stop mouse-adjustment mode. In the dialog, will be sensitivity adjustments and maybe a large font/graphics to display your adjustments see you can see from your scope. You'll want to have good control of your mouse, otherwise the telescope is going to be wandering all over the place!!!

Increased control over tracking method with track bar

Can use arrow keys instead of mouse in tracking adjustment dialog.

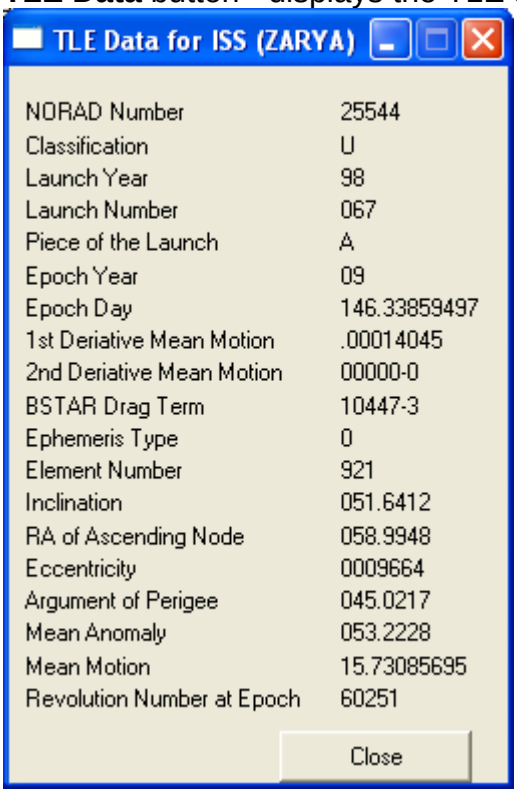
Note that in the dialog box for Options… Preferences , there is an option "Reset Alignment Adjustment to zero when selecting a new object" - if set, then the Alignment value will be reset to 0 when changing to a new satellite. You may find, however, that alignment is "off" for several satellites. If so - unchecking this option will retain the alignment value found for the previous satellite.

## *10.10 Object Data*

Displays the data for the selected satellite in real time
Object Data updates every 0.1 second

**TO BE DONE**

- **TLE Data** button - displays the TLE data for the object, e.g.:




- **Sun Icon** (and text) - **TO BE DONE**

## *10.11 ISS Monitor*

Regardless of what other satellite is being displayed or tracked in the other sections of the user interface, the **ISS Monitor** button extends the interface to the right to show the current details for the ISS.

NOTE - The ISS Monitor function DOES NOT SELECT THE ISS as the satellite for tracking!
If you want to track the ISS ensure it is the satellite selected in the main user interface!

- The button text then changes to **Close Monitor**
- A small dynamically changing map shows the current location of the ISS as well as its field of view.
- The **Next Pass** box displays information about when the ISS will be visible at your location
    - **AOS** - **TO BE DONE**
    - **LOS** - **TO BE DONE**
    - **Max Elev.** - the highest elevation the ISS will attain on this pass
    - **Duration** - the time from AOS to LOS
    - **Alert when visible** - if checked, will send a "beep" to the PC speaker (easily missed)

## *10.12 Mouse Adjustments During Tracking*

**Question:** Why use a Joystick or Mouse with Satellite tracker to center a satellite, rather than the telescope's own fine motion adjustment buttons?

**Answer:** The reason is that the next command from the Satellite Tracker program to the telescope telling it to "GO HERE" will override any fine motion adjustments entered from the telescope's hand controller - i.e. the hand controller will appear to do nothing. On the other hand, Satellite Tracker will apply its mouse or joystick correction(s) to all subsequent positioning commands.

**Tips:**

- Works best only when the scope is properly aligned and locates the satellite well to begin with
- Used for minor adjustments
- The whole correction thing tends to be an art which is perfected with experience.
- The ISS is the toughest target - fast, low, changeable orbit, TLEs must be current.
- Adjustment directions while looking through the finder may differ from the view while looking through the main scope
- Adjustments are "along the track" and "cross track" - i.e. not relative to other common telescope directions
- The Options Preference controls whether the last adjustment is cleared or retrained for each new object tracked
- Some people have had success using a "finger mouse" (a little track ball you twiddle you're your thumb while holding the device with your finger) instead of a "real" mouse or a laptop touchpad
- You have to turn on joystick adjustment every time you run it - it does not save this setting
- **Use small correction steps and wait for them to take effect** - otherwise it shoots past the satellite, you adjust it the other way, and it shoots past it again.

## *10.13 Joystick Adjustments During Tracking*

How I hold my wireless joystick next to the finder scope
to keep the satellite in the centre of the crosshairs.

**Question:** Why use a Joystick or Mouse with Satellite tracker to center a satellite, rather than the telescope's own fine motion adjustment buttons?

**Answer:** The reason is that the next command from the Satellite Tracker program to the telescope telling it to "GO HERE" will override any fine motion adjustments entered from the telescope's hand controller - i.e. the hand controller will appear to do nothing. On the other hand, Satellite Tracker will apply its mouse or joystick correction(s) to all subsequent positioning commands.

**Tips:**

- Joystick trigger can be used to start and stop tracking.
- Joystick uses increment amounts set in preferences
- A wireless joystick ("game controller") eliminates the "tangle" problem
- Works best only when the scope is properly aligned and locates the satellite well to begin with
- Used for minor adjustments
- Hold the joystick 90 degrees clockwise, then pretend your sitting on the satellite facing the direction it is going (stars going the other way), this helps tremendously with proper orientation. This takes out the confusion if you rotate your finder or main scope image with a diagonal.
- The whole correction thing tends to be an art which is perfected with experience.
- The ISS is the toughest target - fast, low, changeable orbit, TLEs must be current.
- Adjustment directions while looking through the finder may differ from the view while looking through the main scope
- Adjustments are "along the track" and "cross track" - i.e. not relative to other common telescope directions
- The Options Preference controls whether the last adjustment is cleared or retrained for each new object tracked
- Some people have had success using a "finger mouse" (a little track ball you twiddle you're your thumb while holding the device with your finger) instead of a "real" mouse or a laptop touchpad
- Paul Goelz - Check out "Finger Pointer" - the perfect Satellite Tracker tweaker while at the eyepiece. If mouse in tweaker mode hit a key on keyboard get back to normal mouse mode. I have Finger mouse 1 but I think Finger Pointer 1 or 2 great for gloved hand!

- **Use small correction steps and wait for them to take effect** - otherwise it shoots past the satellite, you adjust it the other way, and it shoots past it again.

**User Comments:**

- The Timing offset is really forward and reverse (speed up or slow down), and Alignment Adjustment is Left and right (it is miss leading labeled "up and down")
- Next push forward and reverse for catching up to or slowing down, and left and right to do the final right left centering, simple. Just bump the joystick for 1 sec to make the larger correction and 0.5 second to make final adjustments.
- On my LX200GPS 12", it would take 1 to 3 sec to respond, so don't over correct, Wait till it has stopped correcting before the next correction.
- With my Pan 41mm eyepiece and 3048 focal length,0.9 degree field, the complete field is about 3-5 seconds, so if the satellite is at the edge of the eyepiece, I would adjust 2-3 sec. I have centered up satellites with my 11mm Nag.
- Also in options adjust the "alignment adjustments increments to 5 or 10 steps, this way, 1 bump (or click) right or left will show some results. And uncheck "reset alignment to zero". This saves your timings for the next satellite. After about 3 satellites passes I find that most passes need very little corrections, but not all.
- It's usually best to not reset the timing adjustment when going from one sat to another on the same night, since much of the error is likely to be in your computer time.

### 10.13.1 Philips Wireless PC controller (notes from the author)

- My joystick (a Philips Wireless PC controller SGC2910BB/27)
- following the installation instructions I connected the USB wireless receiver to the PC
- Windows XP installed it as a Human Interface Device, HID-compliant game controller
- however, this was not enough to make it operate either in the Windows Control panel test facility or with Satellite Tracker
- next I installed the software that came with the game controller and it installed additional software drivers as well as the Keyboard and mouse emulation software
- the new (changed) Control panel test procedure now worked, and it also worked with Satellite Tracker
- When the "Analog" light is off on the game controller (set by the Analog button) - the left "Directional Pad" and left Analog Joystick both work the same as an 8 position directional switch
- When the "Analog" light is on, the left "Directional Pad" works as an 8 position switch, and the left joystick works as an independent analog joystick
- light on - only the left joystick can be used with Satellite Tracker
- light off - either dpad or left joystick can be with Satellite Tracker
- Up on the joystick = Alignment Adjustment (steps) increase (same as Up button on the UI)
- Down on the joystick = Alignment Adjustment (steps) decrease (same as Down button on the UI)
- Right on the joystick = Timing Offset (sec.) 0.1 second increase (same as the close Advance button on the UI)
- Left on the joystick = Timing Offset (sec.) 0.1 second decrease (same as close Delay button on the UI)
- Clicking buttons 1 thru 4 on the controller = Start/Stop Tracking

# 11. Displays Available Before or During Tracking

**TO BE DONE**

Maps

You can display your entire Viewing Plan on the map. Clicking an object displays its information and double-clicking selects it.

**TO BE DONE**

Map

Next Pass

Alert when visible

# 12. Menu Bar Items

## *12.1 File Menu*

- Open TLE - same as the Open File button in the "TLE File" section of the UI
- Download TLE - same as the Download button in the "TLE File" section of the UI
- Exit - ends the program

## *12.2 Satellite Menu*

- Batch Predictions **TO BE DONE**
- Create View Plan TLE File **TO BE DONE**
- Observation Log Report **TO BE DONE**

"Satellite - Create View Plan TLE File". Use the custom TLE file (containing only objects in the Viewing Plan) by dragging it from Windows Explorer and dropping on the Satellite button of the Meade AutoStar Update Program. On the AutoStar, the object list will be in order of AOS. Satellite Tracker can be used to monitor their current position and the AutoStar to perform tracking when visible.

## *12.3 Telescope Menu (Meade ONLY)*

- LX200 Control **TO BE DONE** - LX200 Control Functions are only available if the telescope type under Preferences is Meade. This is not available for other telescopes.

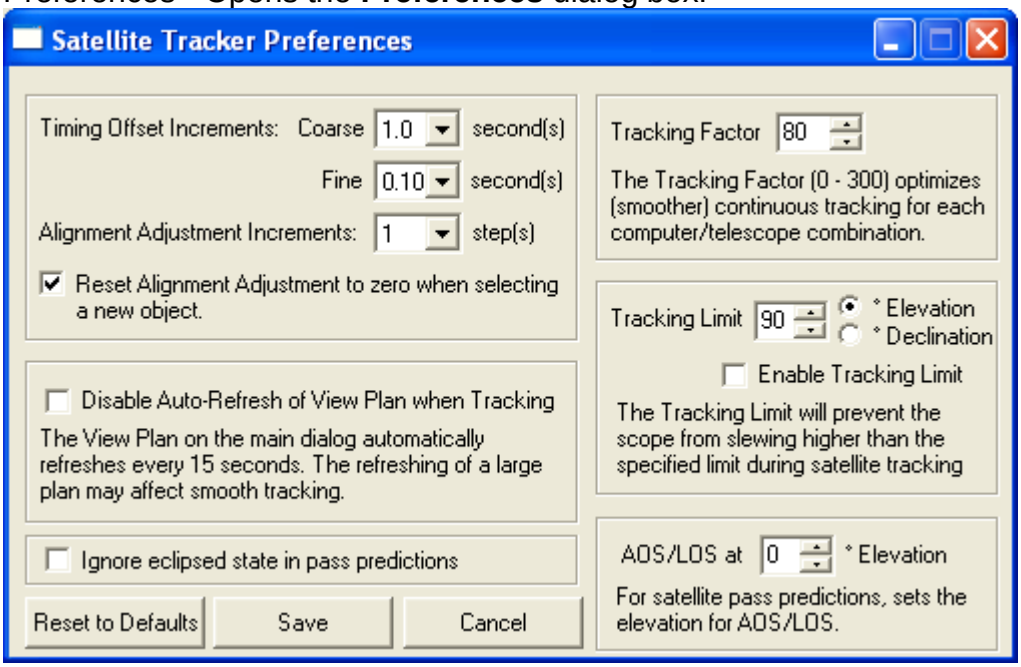

- Note: The LX200 Control setup uses the Meade conventions for longitude (West is positive instead of negative) and UTC offset is positive (instead of negative) as you move west.
- Interface Protocol **TO BE DONE**

## *12.4 View Menu*

- Night Vision - Toggle - Changes Windows to display red text on a black background for most segments of the windows screen in all running applications. The Menu items text will be red on gray for the "active window" and black on gray for inactive windows. Use your computer's Brightness and Contrast controls to adjust your display. Note - clicking this off instantly returns the display colors to "normal" which may seem quite bright after an extended period of Night Vision use.

## *12.5 Options (Preferences) Menu*

- Preferences - Opens the **Preferences** dialog box:




- Preferences dialog allows several custom settings.
- Added Tracking Factor setting to further improve the smoothness of continuous tracking. "Tracking Factor" substantially improves the continuous tracking feature. With prior versions, the object could be seen to "oscillate" within a 3 second or so period. Depending on the computer speed, Satellite Tracker would send data to the scope at too fast of rate and the LX200 Serial-in buffer would fill waiting to be processed by the scope. This would result in data becoming "stale" in the buffer and the scope would then lag behind the object when it processed this stale data. When fresh data then hit the buffer, the scope would jump ahead to catch up with the object again. To solve this, the tracking factor is actually a time delay expressed in milliseconds. The idea is to send data to the LX200 at the same rate as it can actually process the commands and therefore data does not build up in the receiving buffer and become stale. The ideal delay will vary from computer to computer as different computers will calculate and be prepared to send the data at different rates. Those who beta-tested this release, reporting ideal tracking factors from 60 to 160.
- "Tracking Factor" is not available with some telescope selections.
- **TO BE DONE** screen shot and description of each

Ability to limit the maximum elevation when tracking in the preferences dialog
Ability to limit declination when tracking
Option in preferences to ignore eclipsed state when predicting passes
**Tracking Limits - are in "Options, Preferences"**

## *12.6 Help Menu*

- Help Topics - displays the Help file included with the download - Note - the "Help" HTML page displays in a browser and does not obey the Night Vision setting
- Legal - displays the same legal disclaimer as when the program starts

# 13. Troubleshooting

A. Verify that your location settings are correct. Northern latitudes are positive and Southern Latitudes are negative. Western Hemisphere longitudes are negative numbers. Values are entered as degrees (and decimal points of a degree.) For example a latitude of 43 degrees and 42 minutes would be entered as 43.7 (43+(42/60)). View the world map to verify that your location is shown correctly.

B. Verify that your UTC offset is correct. Adjust for Daylight savings if appropriate. Western Hemisphere UTC offsets must be entered as negative numbers.

C. Use up to date TLE files. The TLE file supplied in the program download is out-dated. Download daily if possible.

D. Your computer clock must be accurately set, to the nearest fraction of a second if possible.

E. Try adjusting the timing offset. (usually somewhere between -5 to 5 seconds.)

F. Start with low altitude objects. (these are usually brighter and easier to see)

G. Keep trying different objects and refresh the object list frequently.

H. If the joystick cannot adjust the timing/alignment settings then recalibrate it in the Windows Control Panel - Game Controllers.

I. Verify that the communication between your PC and the telescope is operating properly and determine the appropriate COM port by testing it with the software that came with your telescope.

J. Tracking (slew) Limits - **TO BE DONE** Celestron telescopes internally check the position they are commanded to go to against an internal set of limits (defaults, or as defined by the scope owner). When this limit is reached, the Hand Controller displays "Slew Limit Error" and it refuses to accept any more commands from the serial interface. To recover from this condition, you must press "Undo" on the Hand Controller. So when the tracking screeches to a halt, the first thing to do is to check for this message on the Hand Controller

K. Unable to download any .TLE files from Space-Track.org via the download section in Satellite Tracker - the Satellite tracker program freezes for ~10 seconds and then displays a dialog box saying "Open file error- Could not open C:\LXAT\ full_catalog. tle". If this happens, ensure your userid and password for Space-Track.org was entered correctly. The easiest way is to open SAT.INI with notepad and look for SpaceOrgLogin= and SpaceOrgPwd= near the end of the file. The several second delay in downloading is normal and is due to processing your login at Space-Track.org.

# 14. The SAT.INI Initialization File

What follows is the contents of an example SAT.INI file. **You should not edit this file.**

```
; Satellite Tracker INI
;
; Copyright 1999-2007 Brent Boshart
; http://www.heavenscape.com
;
; (Do not edit)
;
        Version=2.4.9
        Direction=All
        TimingOffset=-1.85
        ElevationLimit=10
        ElementsFile=C:\Program Files\LXSAT\visual.tle
        LastLocation=1
        LocationLatitude1=50.772471
        LocationLongitude1=-114.02790
        LocationAltitude1=1142.4
        LocationUTCOffset1=-6
        LocationName1=WCO
        LocationLatitude2=
        LocationLongitude2=
        LocationAltitude2=
        LocationUTCOffset2=
        LocationName2=
        LocationLatitude3=
        LocationLongitude3=
        LocationAltitude3=
        LocationUTCOffset3=
        LocationName3=
        ComPort=3
        SunOnly=0
        Favorites=0
        NeverObserved=0
        Obj>Elevation=0
        ObjRising=0
        ObjAlt=ALL
        TrackMethod=0
        ObjVis=ALL
        MinPredictPass=2
        ExcludeDaylightPass=0
        WorldMap=0
        ZoomMap=0
        TestTimingStart=-2
        TestTimingEnd=2
        TestTimingIncrement=.5
        TestTimingIncrementFrequency=4
        BatchExcDaytime=0
        BatchMinPass=2
        BatchMaxElevation=0
        BatchIncludeLow=1
        BatchIncludeMod=0
        BatchIncludeHigh=0
        BatchPeriod=15
        RemoveAfterSelect=0
        TrackAdjust=80
        CoarseTimingIncr=1
```

FineTimingIncr=.1
AlignmentIncr=1
ResetAlignment=1
ScopeType=NEXSTARGPS
ShowViewPlanMap=0
PrintVPFile=0
NoradSort=0
TimingMouseAdjust=0
AlignmentMouseAdjust=0
TrackingLimit=90
TrackingLimitEnable=0
LimitElevation=1
Audit=0
LogInterval=1
MakeTLEAddAOS=0
DrawConLines=1
CalcVPWhenTracking=0
BatchPredictRange=0
BatchFavoritesOnly=0
BatchNeverObserved=0
AOSElevation=0
ViewObsReport=0
LX200TimeAdjust=0
ISSMonitor=1
NGPSMount=2
NGPSSetRateDelay=750
MinNxDeltaRate=50
LGPSMount=1
IgnoreEclipse=0
LXRateChangeDelay=1.2
SpaceOrgLogin=xxxxxxxx
SpaceOrgPwd=xxxxxxxx
TleName1=visual.tle
TleId1=22
TleName2=iridium.tle
TleId2=10
TleName3=sp_Interest.tle
TleId3=24
TleName4=full_catalog.tle
TleId4=2
DefaultTLE=1
MaxTLEDownloadTime=30

# 15. The Observation Log Files

## *15.1 obslog.dat*

What follows is the contents of an example obslog.dat file.
**You should not edit this file**.

This is a proprietary format ASCII file used by Satellite Tracker to log the information about observing sessions. It is best handled by the program for adding items and displaying the contents.

25544 ISS (ZARYA) 2009052123:10:59WCO 50.772471 -
114.027901142.4C:\LXSAT\visual.tle +0.768384 22:59:06 23:05:23 00:06:17 42513 -.68 0
Celestron NexStarGPS2.4.9 got it

## *15.2 observed.dat*

What follows is the contents of an example observed.dat file.
**You should not edit this file**

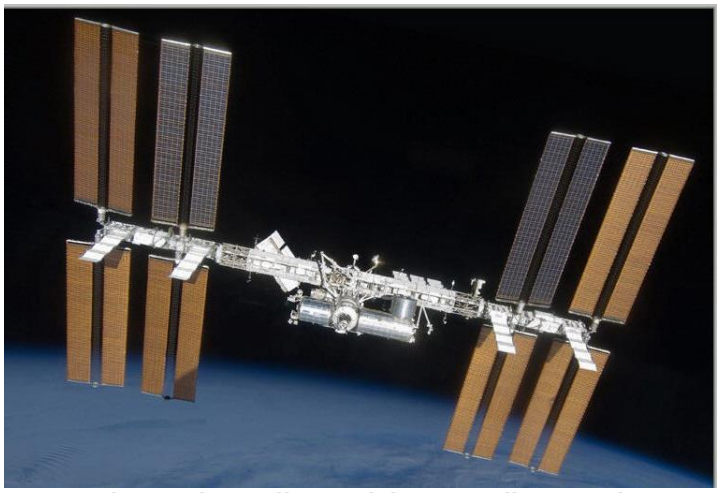
This is a proprietary format ASCII file used by Satellite Tracker to log the information about observing sessions. It is best handled by the program for adding items and displaying the contents.

02554411

# 16. Tracking The ISS

**NOTE - The ISS will periodically pass directly in front of the Sun or the Moon.**
**THIS IS DANGEROUS! - even a few seconds of pointing your telescope at the SUN can cause instant, permanent blindness to visual observers and can burn out sensitive optical sensors and cameras. If you are not an expert - then DO NOT observe daytime passes.**

**The International Space Station is big, bright, favorite target for users of Satellite Tracker**



**The ISS in April 2009 (photo credit: NASA)**

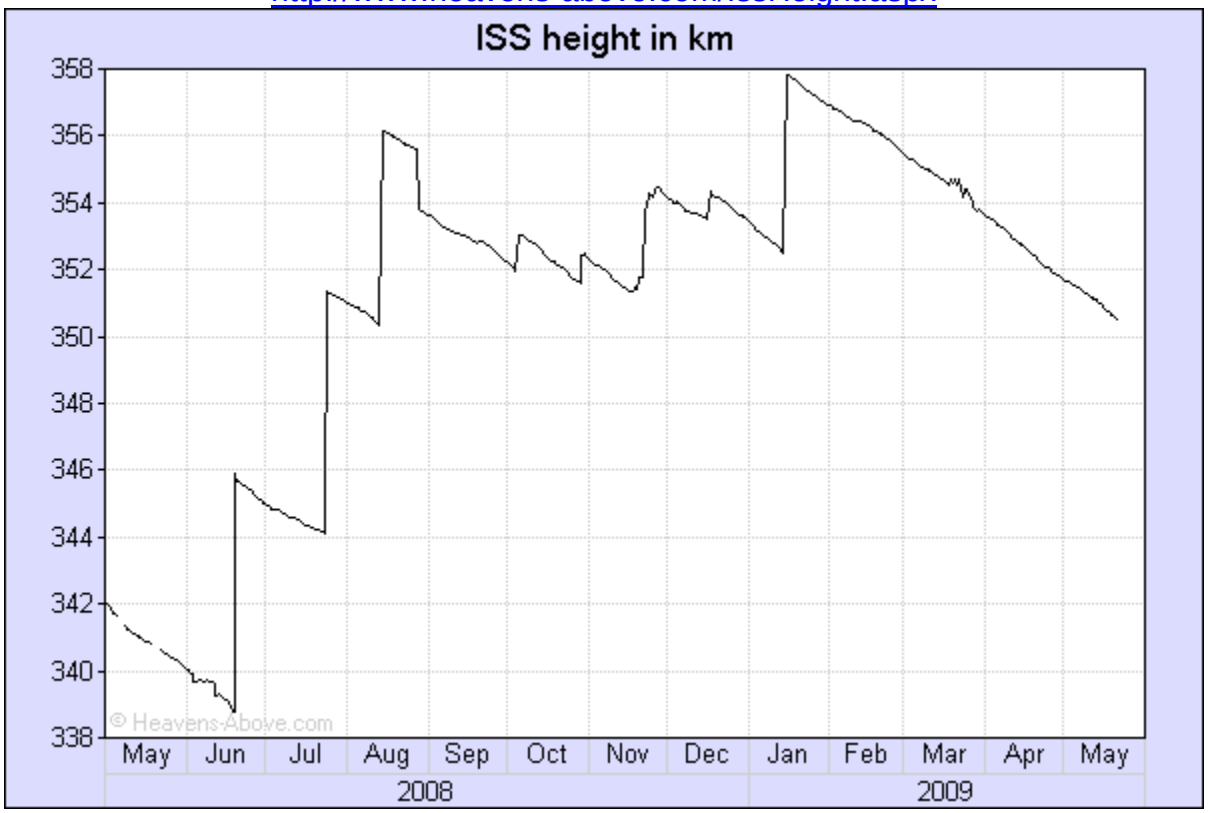
The size of the ISS compared to the Moon (photo credit: Larry McNish)

**However, the ISS is often a difficult target.**

The ISS orbit is low, fast and changes daily. Atmospheric "drag" from the upper levels of the Earth's atmosphere causes the ISS to "sink". Irregular periodic "reboosts" cause the ISS to "rise". Visits from the Space Shuttle and Soviet Progress vehicles change its mass. And finally, "dodging" orbiting space debris is necessary - sometimes with very little lead-time.

All these situations result in the orbit of the ISS changing from day to day as shown below. You can see the recent history of the changing height of the ISS at::

http://www.heavens-above.com/IssHeight.aspx




In order to track a satellite, the very latest TLEs are necessary, and in the case of the ISS, we recommend that you download the TLEs as close as possible to your observing time. Even so, the ISS may not appear "dead centre" in the eyepiece or camera since its orbit may have changed slightly since the time the TLEs were published. TLEs from NASA and Space-Track.org may differ immediately after an ISS "re-boost" *apparently* because NASA will publish the elements of the predicted new orbit, whereas Space-Track, etc have elements based on observations.

**ISS Orbital characteristics**. Due to its low orbital altitude, an ISS pass will generally appear to rise slowly from the western horizon and its image will be quite small since the distance from the observer to the ISS is approximately 1400 km. As the ISS passes overhead, its apparent velocity increases and its apparent dimensions increase since its distance has shrunk to about 350 km. This is where some telescopes have trouble following the ISS since it is travelling so fast, and since fork-mounted telescopes must take time to rotate themselves 180 degrees in azimuth in order to keep following it. Some Equatorially mounted telescopes also have a problem crossing the north-south meridian. After the overhead pass, the ISS appears to get smaller and slow down as it approaches the eastern horizon.

So, the best "views" are directly overhead - exactly where some telescopes have a problem following it.

NOTE - Opening the ISS Monitor on the right side of Satellite Tracker will NOT select it for tracking. You must remember to select it as the satellite to be tracked in the main user interface.

Practice and PreCheck - Your ability to center and track the ISS using the program adjustments will get better with practice. We also suggest that, while waiting for an ISS pass, you test everything out by tracking other satellites (i.e. one or more "dry runs"). If you can acquire and track those, you should be ready for an ISS pass.

The ISS is identified as ISS (ZARYA). The software puts "***" in front of popular objects like ***HST and ***ISS(ZARYA) so they stay at the top of the satellite selection list. If you search down in alphabetical order you won't find it.

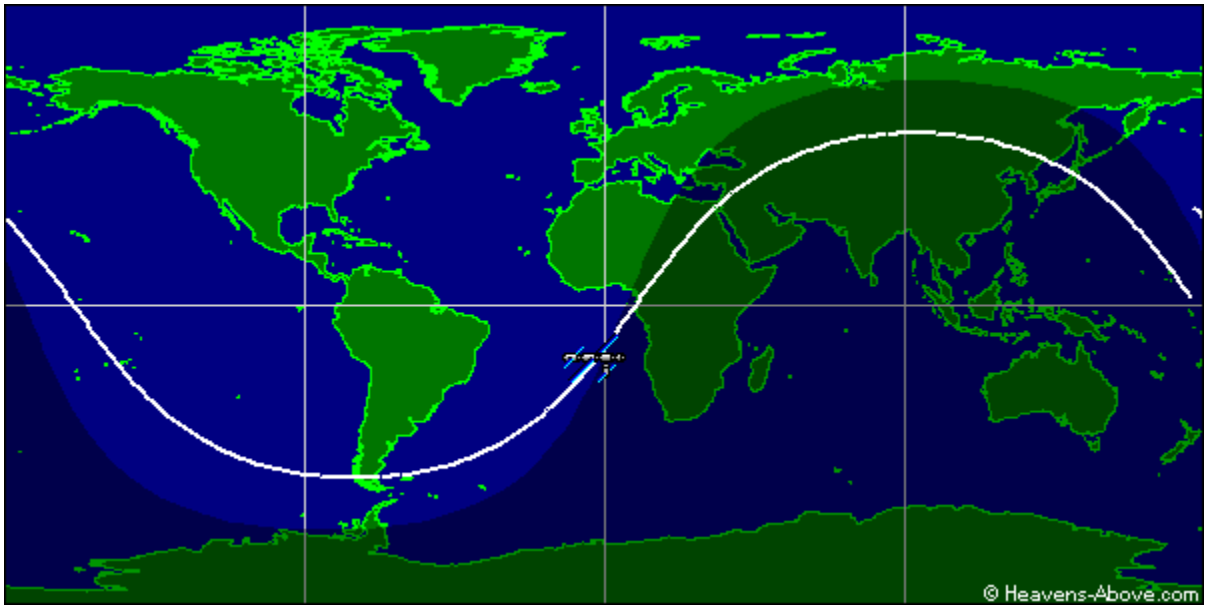
The ISS is tough to track for imaging. Keep trying and developing your technique. Practice.

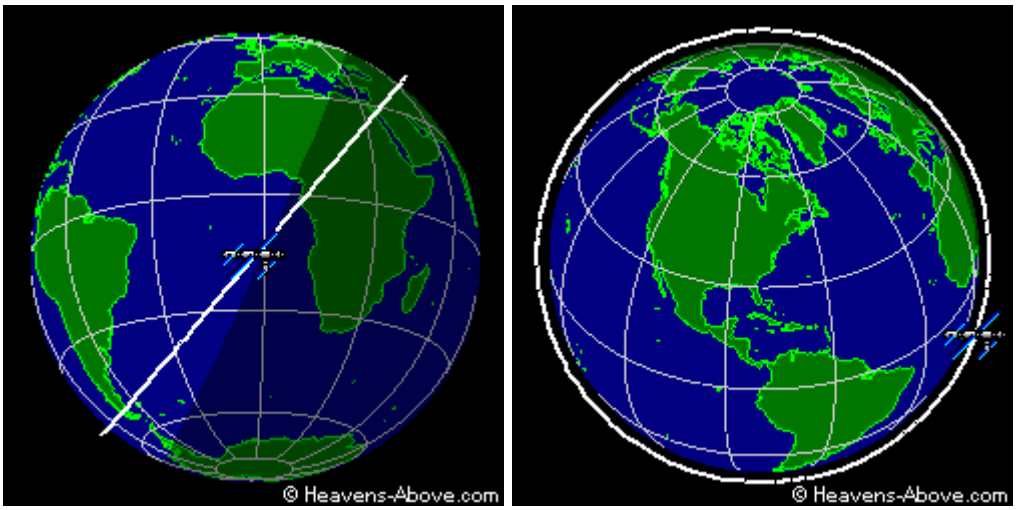
Photo tips:

- The ISS is a large satellite but a small target (see the comparison to the size of the Moon above)
- A long focal length and high magnification is required to see detail
- High magnification requires a rock-steady mount, no wind, near-perfect telescope alignment, and careful focusing on a star or the Moon beforehand
- The ISS is moving quickly - use the highest shutter speed and ISO settings you can
- Don't forget clean optics and good collimation

## *16.1 The "ISS Marathon"*

Occasionally, the ISS orbital plane in space (which is tilted 51.6 degrees with respect to the Earth's equator), lines up perpendicular to the Sun angle at the Earth as shown below. At this time of year, the ISS orbits near the Earth's terminator, totally in sunlight and so is continuously visible for many orbits since it does not enter the Earth's shadow. Night time passes are lit up from horizon to horizon, and daytime passes are visible against a blue sky. This configuration only lasts 2 or 3 days.




**July 7and 8, 2009**

Therefore you will get to see several passes of it in a row (approximately every 91 minutes) rather than just one or two. This is what's known as the **ISS marathon**. The position on the sky changes for each orbit, since, during the approximate 91 minute orbit of the ISS, the Earth rotates carrying you about 15 degrees further east, until you cannot see the orbiting station until the next day. This displacement effect is smaller at higher latitudes.

The times this happens varies from year to year since the orbit is not constant, and differs between the Northern hemisphere and the Southern hemisphere. Look for announcements as to the dates.

Here is a link to the Sky & Telescope article on this subject:
http://www.skyandtelescope.com/observing/highlights/19133199.html

It is also mentioned on http://spaceweather.com/

Darwin Teague made a web page with a couple of videos that shows the mechanism of the I.S.S. marathon at: http://darwinsastroworld.com/marathon.htm using "EOO" Earth Orbit Objects from http://www3.telus.net/public/boucherd/eoo.html

**History of the "Marathon":**

On June 8, 1996 an e-mail was posted on www.satobs.org by Dave Mullenix. Dave called "seeing Mir five or more times in one 24 hour period a "**Mir Marathon**". These observation marathons became an annual event. (The Russian space station Mir was the world's first consistently inhabited long-term research station in space. Its first component was launched in 1986-02-19, and the space station re-entered the Earth's atmosphere 2001-03-23.)

The first mention of an "**ISS Marathon**" on satobs was May 19, 2003 from: Edward S Light. (On-orbit construction of the International Space Station began in 1998, and is scheduled to be complete by 2011.)

**Mathematically**

Paraphrasing Bruno Tilgner on satobs:

1. The difference between the right ascension of the ascending node of the satellite's orbit and the right ascension of the sun must be near 90 degrees, i.e.

   RAascending_node = RAsun + 90°

   Actually, "close to 90°" is close enough - there is a small band on either side of 90° when it can happen.

2. The Sun's declination must have a certain minimum value which depends on the inclination of the orbital plane and the height of the satellite above the earth.

   Assuming a circular orbit of 400 km altitude and an inclination of 51.6 deg, a simple calculation will show that the minimum declination must be at least 18.6°.

3. The same phenomenon occurs for the southern hemisphere. But in this case the condition for Right Ascension is:

   RAascending_node = RAsun **-** 90°

   (again, with a small band), and the declination of the sun must be below -18.6°.

Similar considerations apply to virtually all satellites in low earth orbits but become more complex if the orbit is eccentric.

The marathon can only be observed from sufficiently high northern latitudes. At lower latitudes fewer consecutive passes can be observed because the longitudinal displacement from one orbit to the next due to the rotation of the earth is too great. At very high latitudes, on the other hand, the satellite may not rise sufficiently high above the horizon to be seen. This is tougher in the southern hemisphere because there are few land masses at suitable latitudes.

An alternative (but equivalent) explanation is stated by Björn Gimle:

"Near the Summer Solstice, if the ISS Northern Apex happens to be near local midnight, the entire orbit is sunlit. Of course the same is true for the Southern Apex near Winter Solstice. (This requires special attention for the thermal balance of the station and visiting Space Shuttles due to the continuous sunlit heating). Moreover, it allows observers some 10 degrees "below" the apex to see from 5 to 6 sunlit passes during one night".

# 17. Misc

**TO BE DONE**
**Various Math formulas that might be of interest**

Resolution of 8-inch telescope, 0.6 arc sec.

At a range of 250 miles (nearest approach), or 1,320,000 feet, one second of arc is equivalent to 1,320,000/206265 = 6.4 feet. 0.6 arcsec thus equals about 4 feet, the smallest separation between two objects we should expect to see.

The new solar panels span 240 feet, which at a range of 250 miles is

240/(250*5280)*206265 = 37.5 arc sec.

At 78 power, the panels would apparently span 0.812 degrees, at 156 power they would span 1.6 degrees, and at 234 power (3x Barlow) they would span 2.44 degrees or 5 times the diameter of the naked-eye moon. So it would be very much worth the effort to refine the tracking as much as possible.

At a minimum distance of 225 miles, the angular size of the largest (240-foot) solar array is

[240/(225 * 5280)] * 206265 seconds of arc , or 41.7 seconds of arc.

At an elevation of 45 degrees, that becomes (0.7071)(41.7) or 21.5 seconds of arc. Bigger than you thought!

Brent Boshart

Others

NOVA for Windows - http://www.nlsa.com/index.html $59.95

WXtrack - http://www.satsignal.eu/software/wxtrack.htm

Orbitron - Satellite Tracking System - http://www.stoff.pl/

A thread has been running recently on SeeSat-L list, about software/hardware for satellite tracking.

It starts with http://www.satobs.org/seesat/Mar-2008/0297.html and the current post by me on connecting is: http://www.satobs.org/seesat/Mar-2008/0323.html (actually in a separate thread with slight title variation)

A third variation is http://www.satobs.org/seesat/Mar-2008/0304.html

You can see them all at http://www.satobs.org/seesat/Mar-2008/subject.html Scroll down to "Telescope"

/Björn

# 18. Version History

**TO BE DONE**

**The more of this we incorporate into the manual - the less we need this section, other than for an historical account - points that have been incorporated into the manual are now in Strikethrough**

### Version 1.1.2 2000.05.08

1. ~~Ability to connect to COM 3 and COM 4~~
2. ~~If not connected and tracking is started the program will attempt to automatically connect to the telescope.~~
3. ~~Improved continuous tracking (greater frequency of "goto" commands). The "Delay" and "Advance" buttons now adjust the "Timing Offset" in increments of 0.5 seconds.~~
4. ~~Maps only update once every 10 seconds.~~
5. ~~"Reset filters" button to reset filters to include all objects.~~
6. ~~New "Favorites" and "Never Observed" filters (as recorded in Observation log).~~
7. ~~Observation log. Can record comments for each object. "Favorites" and "Observed" check boxes are used for filtering. "Stamp" button quickly records a sighting.~~
8. ~~Ability to create a viewing plan. User can create a viewing plan ahead of time so important objects will not be missed. Objects are added to the plan using the "Predict Pass" dialog. When an object in the plan becomes visible a bold red font notifies the user. The user can select the object from the "Viewing Plan" dialog.~~

### Version 1.1.3 2000.05.15

1. ~~Exclude Daytime Passes checkbox in the Predict Passes Function.~~
2. ~~Increased control over tracking method with track bar.~~
3. ~~Improved continuous tracking.~~

### Version 1.1.4 2000.05.16

1. ~~Improvements to computer/telescope interface. Verifies connection to telescope. Autodetects whether telescope is capable of long format coordinates for improved tracking precision.~~

### Version 1.1.5 2000.05.22

1. ~~Observation Log Button indicates whether a log exists or not.~~
2. ~~New alignment buttons allow adjustment perpendicular to the path of the satellite. NOTE: An alignment adjustment should be rarely needed. This adjustment may be needed if the LX200 has not been accurately aligned or using higher magnifications. Because the degree of misalignment will vary along the path of the satellite the adjustment may need to be changed during tracking.~~
3. ~~New world map and orthographic mapping option.~~
4. ~~Object Data updates every 0.1 second instead of 1.0 second.~~
5. ~~Fixed bug. Setup was not saved when exiting by menu.~~
6. ~~Improved continuous tracking, smooth!~~

### Version 1.1.5b 2000.05.27

1. ~~Fixed Tracking Bug with Deep Space Objects.~~

### Version 1.1.6 2000.05.30

1. Uses NORAD SDP4 Orbital Model for Deep Space Objects. (Previously only used NORAD SGP4)
2. Fine and Coarse adjustments of Timing.
3. Zoom map option.

### Version 1.1.6b 2000.07.10

(Last Freeware Version)

1. Alignment adjustments corrected. Now consistently adjusts perpendicular to the flight path of the satellite.

### Version 1.1.7 2000.06.10

*** This version and subsequent versions are not freeware ****

1. Ability to skip to another date in Predict Pass Dialog.
2. "Timing Find" dialog assists in finding proper timing offset.
3. Object Information Database.
4. Other minor changes and bug fixes.

### Version 1.1.8 2000.06.20

1. Night Vision Mode (Red Screen).
2. Joystick Control of Timing/Alignment.
3. Batch Satellite Pass Prediction to predict passes for an entire TLE file.
4. Satellite circle of visibility drawn on maps.

### Version 1.1.9 2000.07.07

1. "Remove after Selected" option in Viewing Plan Dialog. Objects are deleted out of view plan after being selected for tracking. Viewing Plan Dialog is enlarged.
2. Joystick trigger can be used to start and stop tracking.
3. New "Geostationary Only" filter.

### Version 1.1.9b 2000.08.17

1. Alignment bug in Viewing Plan Dialog fixed.

### Version 2.0.1 2000.10.11

1. Various minor bug fixes.
2. LX200 Control Functions.
   Note: The LX200 Control setup uses the Meade conventions for longitude (West is positive instead of negative) and UTC offset is positive (instead of negative) as you move west.

### Version 2.0.2 2001.01.02

1. Added Communication ports choices 5,6,7 and 8. Fixed bug when using USB to Serial Port Adapters.
2. Function to delete all entries in Viewing Plan.
3. Added Tracking Factor setting to further improve the smoothness of continuous tracking.
4. Preferences dialog allows several custom settings.

Version 2.0.2 is now available for registered users. This version includes a parameter called "Tracking Factor" which substantially improves the continuous tracking feature. With prior versions, the object could be seen to "oscillate" within a 3 second or so period. Depending on the computer speed, Satellite Tracker would send data to the scope at too fast of rate and the LX200 Serial-in buffer would fill waiting to be processed by the scope. This would result in data becoming "stale" in

the buffer and the scope would then lag behind the object when it processed this stale data. When fresh data then hit the buffer, the scope would jump ahead to catch up with the object again. To solve this, the tracking factor is actually a time delay expressed in milliseconds. The idea is to send data to the LX200 at the same rate as it can actually process the commands and therefore data does not build up in the receiving buffer and become stale. The ideal delay will vary from computer to computer as different computers will calculate and be prepared to send the data at different rates. Those who beta-tested this release, reporting ideal tracking factors from 60 to 160.

**Version 2.0.3 2001.01.16**

1. New Viewing Plan Map graphically maps all objects in viewing plan.
2. Ability to temporarily adjust date/time without affecting system date/time.

**Version 2.0.3b 2001.01.17**

1. Bug fix

**Version 2.0.4 2001.03.10**

1. Tracking Adjustments can be done with a mouse.
2. Fixed bug in date/time adjustment.
3. Support added for non-Meade telescopes with a LX200 emulation interface protocol.
4. Support for Meade AutoStar telescopes.
5. Display TLE data.
6. Sort by NORAD number in Object List.
7. Create a new TLE file containing only objects in the Viewing Plan. (For download to the AutoStar)
8. Ability to simulate tracking without a scope and write coordinate data to a text file. Can also produce a text file of coordinates for an entire pass from the text version of the Viewing Plan.
9. Ability to limit the maximum elevation when tracking in the preferences dialog.

**Version 2.0.5 2001.03.25**

1. Sky View map. Shows 900 brightest stars.

**Version 2.0.5b 2001.03.31**

1. Bug fix

**Version 2.0.6 2001.04.25**

1. Ability to print View Plan or create tab delimited text file.
2. Option to Draw Constellations in Sky View Map.
3. Pass Predictions can be copied to the Windows clipboard.
4. Pass Predictions include direction (e.g. NW) at AOS and LOS.
5. View plan list on main dialog.

**Version 2.0.6C 2001.05.12**

1. Fixed bug with Autostar interface and new Meade firmware.

**Version 2.1.1 2001.05.30**

1. New detailed observation log. Can create an ASCII tab delimited file of log.
2. Ability to set degrees elevation for calculating AOS and LOS.
3. New filters for batch predictions: minimum range, never observed and favorites.
4. Ability to limit declination when tracking.

**Version 2.1.2 2001.08.27**

1. ~~Remembers last location in use.~~
2. ~~Finer increments in alignment adjustments~~.
3. ~~Joystick uses increment amounts set in preferences.~~
4. ~~Can use arrow keys instead of mouse in tracking adjustment dialog.~~
5. ~~LX200 Date/Time can be adjusted with Time Adjust feature.~~

**Version 2.2.1 2001.09.25**

1. ~~Telescope interface support for Celestron Ultima 2000 and NexStarGPS.~~

**Version 2.2.1b 2001.10.31**

1. ~~Bug fixes in Mouse Adjustment dialog.~~

**Version 2.3.1b 2001.12.28**

1. ~~ISS Monitor Option~~

**Version 2.3.8d 2003.01.10**

1. ~~NexStar 5/8 Interface (beta version)~~
2. ~~Continuous Tracking Interface for NexStarGPS~~
3. ~~Velocity added to object data.~~

**Version 2.4.1 2003.05.19**

1. ~~Telescope interface support for Meade LX200GPS (Continuous tracking)~~
2. ~~Option in preferences to ignore eclipsed state when predicting passes~~.

**Version 2.4.5 2004.06.30**

1. ~~Telescope interface support for Celestron CGE (Continuous tracking)~~

**Version 2.4.6b 2005.03.02**

1. ~~Automatic download of TLE files from http://www.space-track.org~~

**TO BE DONE - (not included in the "help" file)**

**Version** 2.4.7 ?

**Version** 2.4.7a
**Version** 2.4.7c

**Version** 2.4.8- prev
The only significant difference between 2.4.7 and 2.4.8 is the maximum number of objects that can be loaded from the TLE file (increased to 20,000).
latest FREEware version of Satellite Tracker

**Version** 2.4.9 - current May 2009

**E-Mail History**

**TO BE INTEGRATED INTO THE MANUAL ABOVE IF IMPORTANT**

As long as you're soliciting wish lists: how about using the parallel port to connect to a 4-button hand control for tweaking the satellite position in the field? It's pretty hard for one person to use the laptop keyboard or mouse for this, since the telescope operator is looking through an eyepiece in a different place. Making a controller box from Radio Shack parts should be pretty easy.

I seem to recall a comment about making the alignment adjustments work along and across the path, but that's not really necessary, since while tracking there's no relative motion of the satellite. You can't tell which way it's going anyhow. Adjustments in RA and DEC would be fine.

Instead of that, how about implementing a special mode where the mouse movements were interpreted as +/- adjustments. Move the mouse up and down and it adjusts the DEC. Move the mouse sideways and it adjusts the RA. A click at any time would cause it to revert to normal operation. That way anyone with any sort of mouse could use it to make the adjustments. You can even run a mouse on your pants leg in a pinch. Touchpads and the little eraser thingy on my Thinkpad would all work fine. And no external device would be required.

If RA and DEC are adjusted, then won't you have to keep adjusting as the satellite moves across different parts of the sky? I would think that adjusting in relation to the flight of the satellite would give you more consistent centering as it moves across the sky, esp. if adjustment is needed because of timing and/or stale TLE files. If you orient your joystick in line with the direct of the sat. movement it becomes less confusing. In a couple of days, I will have a mouse adjustment option done. I post it for beta testing.

Brent

Brent,

Out of using your software for 6 months, below are comments and possible suggestions (also for the benefit of the discussion group: it is a great idea!), in roughly declining order of importance:

1- Allow the choice of using the NORAD # to select a satellite: satellite names do change (Anik-As to Ds were sold to other countries, for instance).
2- Improve the Earth view through a full screen image, a higher resolution model, and deeper zoom features (this view is what I use the most for public viewing. last summer we showed it to a group of 2500 people).
3- Add more "Locations" choices.

4- Add in "Object Data" section: orbit period, inclination, number and velocity; launch date with month & day.
5- In main window, "Altitude" should have "Mid" or "Med", but not "Mod" as the middle orbit choice.
6- Compatibility with Celestron NexStar (a very popular telescope right now).

Sat Jan 20, 2001 You can a download an experimental version at
Email me some feedback on the Tracking adjustment by mouse. Brent

. I noticed that "reset to zero" does not actually reset the offsets to zero. It gets close but not to zero.

It actually resets to the values when you first entered the mouse adjustment dialog.

I would really like to see a mask to limit telescope movement.

In the NASA tracking lingo ground station or satellite a gimbaled antenna has a horizon mask and a keyhole mask. The horizon to keep it from looking at ground or radiating the buildings nearby. The keyhole mask area where antenna can't slew fast enough or to avoid some type ok obstruction.

Keyhole mask for LX-200 would really help to prevent bending the gear on the back of the telescope and maybe buggering up drive gears.

1. Provide a "superfine" mouse sensitivity; about 1/5 of the "fine" sensitivity.

Sounds good, will do. No clear skies here so I was only guessing.

I agree, but how about an adjustable sensitivity so anyone with any kind of mouse could set it appropriately. FWIW, I found the fine sensitivity to be OK but perhaps just a bit more sensitive than I needed.

I actually like the mouse screen. a lot. A couple times I drove the sat off the screen but had remembered the correct position on the mouse screen. it was a simple matter to put the mouse back in the approximate same position and re-acquire the sat. It's also nice to get a quick graphical picture of the offset adjustment.

Try a finder cam in addition to the main camera. Even easier to find and center a sat. I use a second PC23C with a used 230mm zoom camera lens (has an integral 1/4-20 tripod mount so it attaches to my piggyback mount).

I feel so SILLY! I guess I never tried to move the mouse screen!

OK, so now that I know it is moveable, how about making it smaller and can it remember it's last position and return there the next time it is opened?

OK, now I remember what I REALLY meant about the scope position display! During tracking, the current sat position is of course the current scope position. But what I was getting at was that it would be nice to have a display of the current scope position when tracking has stopped. If you forget where the scope is, it would be nice to be able to see its position (in alt-az or polar, depending on how you were mounted).

Or how about this. a feature that selects the sat that is the closest to the current scope position. THAT would be handy!

I know, we're never satisfied!

What I've done is made a track bar to adjust the sensitivity with 5 different positions.

Brent

1. Focusing. It would be nice to have a focus in-out adjustment (I've ordered the JMI electric focuser -- will this fiscal irresponsibility never stop?).

2. Telescope control panel: I hit the NEXT button while not connected to the telescope. The only way out of the resulting state was to end the task.

3. As I understand it, there is a LOWER (-than) LX-200 command allowing the user to set a zenith limit in Alt-Az (or, I hope, Declination limit for polar alignment). This can be used to prevent a camera from hitting the mount, which is too easy to do when tracking from a remote viewing site in the dark. The command seems to be "So DD*#" where DD is in degrees ("Go" returns the current setting). I notice you have HIGHER (-than) in the control panel list, but not the other.

I can write the focus and zenith-limit commands for the LX-200 as stand-alone programs, but it would be nice to have them integrated. The "NEXT" problem just requires checking to see if there is a connection.

I want to do some work on the control part of the program in the near future. Right now I am working on some misc. scope interfaces. Apparently the latest Meade ETX software upgrade allows the interface to purge the stack, so we should be able to do a good ETX interface. Also working on an interface for non-Meade but LX200 compatible protocols. When they are finished the final v2.0.4 will be released

Actually you can construct a dual port cable for the LX200 (it can handle input from 2 ports) and communicate with the scope from two different programs with two COM ports. (Until I get to doing the focus option.)

Sun Jan 28, 2001
I'm considering adding a GPS interface to the next version (or perhaps the following one) to Satellite Tracker. This would allow the automatic capture and setting of location coords. and setting of system time. Any interest?

The next release will have a number of new scope interfaces. I am getting good reports back from an ETX user, Losmandy-Gemini and Astro-Physics user. Will work on a NexStar interface next.

After the scope interface project, I will consider a skyview map. I need to find info on how to plot different projections. Anybody know a source?

Sorry about the EGroups to Yahoo switch-over, I would have warned everyone but didn't realize it myself.

Brent - Would it be possible for you to add filters in sattracker to filter based on different categories of satellites. IE "show only GPS" or "show only naked eye visible satellites" or "show only iridium satellites"

Never a shortage of ideas is there?

Jeff

If I can't derive the info for the filter from the TLE, that means I need to maintain a separate database. It would continually need to be updated as new satellites are continually launched. Sounds like a lot of work and I would rather spend the time on programming new features etc. I was thinking about adding user-defined groups so you could create and maintain your own groups whether it be naked eye visible, GPS or whatever. Maybe users could then post their grouping definition files to the Files section of this discussion group and they could be shared?

Brent, I tried the latest release with the mouse control for offsets. Were there many requests to refine the fine adjustment even further?

Yes, I have done this. There is a track bar to adjust the sensitivity. The finest should meet your needs. I've been holding back the latest release to hear more from the beta-testers of the new scope interfaces.

Sat Feb 10, 2001 - Satellite Tracking 2.0.4 PreRelease Version

This has been ready for some time but I'm still waiting to hear back from ETX users on the ETX interface. I think I found a good excuse to buy one of every computerized telescope available but my wife hasn't bought it yet! However, I'm planning to purchase a NexStar and doing something for it.

You will see the tracking corrections by mouse has sensitivity options. Let me know if you can't find an appropriate setting for your needs.

By the way, did anyone get images when the shuttle was docked to ISS? It made a 88 deg. elevation pass over my location last night but had cloudy (and very stormy) skies! Doh!

Most of all, have fun!!!

Brent

ps. Bill have a look at the preferences, hope this is what you wanted?

Ray Talipsky wrote:

?? Create Observation Log -- I logged all the sats I successfully observed -- where it went I know not???

The logs are separate for each sat. Call up the sat again see the log

*** suggest open one log per session give it date-time file name add entries each time use observation log button *** *** then just view with any text editor Object info start track time end track time comments etc ***

Great idea!

I did viewing plan with "visual TLE" set then with "mcants TLE" set noticed it wiped the Viewing plan with selection of new TLE file --- is it suppose to work this way?

Yes suppose to work that way, the calculations in the viewing plan are no longer valid when you switch TLE files and the Sat may not be present in the new file.

I would not like
view plan should not be wiped?
I guess I could edit up a TLE set to do batch on (usually do a sunset to sunset + 120 batch run and select sats I want).
*** Filter suggestion "No Space Junk" pure satellites not rocket booster and other junk guess you could look
*** for "r<space>" in name to get rid of space JUNK? ***

Actually, some boosters are great to view as you can see tumbling motion.

Brent is the best one to answer, but the registered version has a setting that (I think) sets the interval between GOTOs to avoid filling the buffer. He has also added a fine tracking control via the mouse that works GREAT. I track remotely via video cameras, and I can "fly" the sat into the main field of view with the mouse and then it tracks wonderfully.

Fri Feb 16, 2001

I'd suggest trying the latest version (US$20. is almost freeware anyway). With the next release, I will be dropping the freeware version off the site as it no longer does justice to the current version. The next version will have multiple scope interfaces so there may be a slight price increase.

I'll be working with a Satellite tracker user who wants to try to do auto-centering of objects using a video cam and the "Video for Windows" API. I wouldn't want to call it auto-guiding as I don't think it will respond fast enough to improve the smoothness of the tracking but rather auto-centering as it will keep the object centered better (and automatically) in the FOV. Any comments or suggestions that may help with this project?

Brent

Brent,
I've found a non-problem problem with Sattracker. I have a laptop computer that I use exclusively for astronomy and to drive my LX200. To avoid hassles with time zones and daylight savings, I keep my laptop and LX200 set to Universal Time. So here's the problem. When I set Predict Pass to exclude daylight passes, it, I assume, bases it on the time of day of the computer, convenient for you, but screws me up because of the eight hours difference. Is there any way for you to calculate "daylight" hours based on longitude and Universal Time instead of system time in your next revision?

Scott Baker
San Diego Astronomy Association

Yeah, wouldn't it be great to be an astronomer in the 0 UTC time zone! There are of course two different pass calculations one for batch and one that does a 24hr calculation on one object only.

For the batch, I assume this is not a problem since you can set the start time and therefore easily avoid a daytime start time. I'm not sure about your suggestion and what might be the pitfalls. Why does most astronomy software ask for UTC offset instead of calculating from the longitude? Is it issues with daylight savings and the time zones do not follow straight longitudinal lines? Maybe the best solution might be a "daylight" offset factor in the parameters dialog? I know the current calculations sometimes gives a pass during dusk and I would prefer the "daylight hours" to be extended another 30 minutes or so and get passes that are just in the really dark hours.

Brent

Brent,
Maybe a parameter would be the best thing, since one astronomers "daylight" is another's "dusk". Also, "daylight" at the equator is different then at 60 degrees latitude, so my suggestion of a longitude factor is not practical (now that I think of it, Duh!). It's not a big problem, I just leave the check box off and do the calculations in my head on whether or not the satellite is passing during daylight hours. More of a wish list then anything else.
Thanks for your great program!

Scott Baker
San Diego Astronomy Association

Sun Mar 18, 2001
Version 2.0.4 is now available for download at . Its release was delayed until I could get my hands on Autostar scopes to do testing. I personally purchased a Meade ETX70-AT scope and an extra AutoStar 497. Its a great portable little scope when I don't want to drag my LX200 out of the observatory. The latest firmware seems fairly stable not like the early versions. (Bought it slightly used from Astronomics for only $199!!) Its built-in sat tracking feature works fairly well and Satellite Tracker can create a custom TLE file to upload to the Autostar database or you can track directly via the RS232 although only "leap frog" can be done through the RS232. It just cannot process the RS232 data like the LX200 can.

Hope you enjoy the new version.

Brent

Following is the list of new features: [DONE - were in the HELP file]

Fri Mar 30, 2001 Version 2.0.5 is not (now??) available for download at

A Sky View map is now available showing the satellite path amongst the 900 brightest stars. This is the only new feature in this minor release. [DONE - was in the HELP file]

Brent

Brent, this is a great addition to your program. I believe I've discovered a small bug.

When you do a satellite pass prediction for a time in the future, and click on the Sky Map button, the sky that is displayed is for the current time, not the future time.

Brent,
Follow up to Kevin:
Going days into the future, the printed date at the bottom of the sky map advances, but the star positions stay the same.
Thanks,
Robin

Re: V2.0.5 Available

Doh!!! Not a small bug but a big error of omission!! I test and test and then miss something that obvious!!! Anyway, the fix is available (v2.0.5b) on the web site. Sorry guys!

Brent

Eddie:

What version are you using? There was a bug in an earlier version that it used ASCII 233 instead of ASCII 223 for the degree character. It didn't matter with a LX200 but did with some LX200 emulations. If the most current version doesn't work (ASCII 223) then you can add a line in the sat.ini file: DegChar=XXX where XXX is the ASCII value of the symbol you wish to use.

Has anyone come up with the magic combination that will allow my new Losmandy G-11 Gemini track continuously with SatTrack?

It's in a mode now where it switches from slew to center, slew to center, etc. basically it's behind the curve on where it should be pointing. This is the first day that I've played around with the mount. Just made up my serial cable this evening. There are a couple of modes such as viewing and photo. I'll have to play around and see what I can come up with.

I played with the tracking factor and noticed some timing differences between the slew/center changes. What exactly does the tracking factor change?

One possibility is to force the mount to remain in centering mode and increase the centering speed to a rate fast enough to track. But I'm not really sure how the software deals with the G-11 since it's running in eq. mode. I never have looked at the lx-200 command set, but assumed that Sattrack puts the LX-200 into alt/az mode and continuously updates the al/az values???

Anyway if anyone has already figured out the magic combo I'd appreciate it if you could pass along your info.

TIA

Fred

Fred:

I have been working with Rene ( goerlich@. ), the programmer of the Gemini system. At this point the Gemini system can only do leap frog tracking. He is working on a release to allow a smooth transition when the system receives a new goto command and has not yet completed the previous slew. Right now it stops the slew then starts the new slew.

If its behind in tracking then use larger leaps (i.e. set the "Tracking Method" to the far right.). If you are still behind then adjust the "Timing offset" to a larger number.

Satellite Tracker sends RA/Dec coordinates, it does not matter whether the scope is in Polar or Alt/Az mode, the scope firmware converts.

I have done testing with a number of different mounts and truthfully nothing has come close to the LX200 for this specialized application. Its amazing for the rate that it can receive, process data. and slew.

Brent

V2.0.6 which I'm currently working on has the ability to print the view plan. I'll think about a "copy to clipboard" feature so you can cut and paste. I also like your idea about have the direction (e.g. NW) with the AOS, LOS and max elevation times.

Brent

which leads me to the request. It would be super nice if there were a wav file that could alert that a pass was either in progress or better yet, say something like, "one min. warning". It would sure be a big plus for people like me that seems to be side tracked. :-)

Sat Apr 21, 2001 New Beta v2.0.6
If you want to do some testing you can download the beta version of the next release at
New features include: [DONE - was in the Help File]

Please note that a view plan from previous versions will not be compatible with v2.0.6, you will have to delete any existing plan and recalculate with 2.0.6 (because of the AOS and LOS directions being added).

Brent

Brent,

I tried out the beta and would like to ask about/confirm the "Copy to Clipboard" functionality. Unless I am mistaken, it will copy to clipboard only the currently active/highlighted pass. Was this the intended functionality?

I do not know about others but I would vote for copying the complete "Batch Predictions" or "Predict Pass" dialog box. A backdoor method would be to use the "Print" button and redirect printing to a TXT file (I have not tried this but would expect it to work).

Anthony.

Yes, it was meant to copy just the highlighted line, could do a 'Copy All' or create a text file.

Brent

Add magnitude and range to the list above

Mon Apr 23, 2001 New Beta v2.0.6 copyall / text
I vote for Text File (Tab delimited) once you have a text file you can edit it any way you want.
If delimited could suck it into Database program.

How about designated folder for .log files
and
a text log --- ?? What did I track last night??

Fri Apr 27, 2001 Version v2.0.6 Available
Version v2.0.6 is now available at

New Features are: [DONE - was in the Help File]

Brent

I think its time to improve the observation log with predefined data fields instead of just free text, so that some interesting reports can be designed. I need input for the kind of data you would like to record for each observation. The following is a start, grouped into what Satellite Tracker can input and what the user may want to input manually. Please reply with your ideas.

Auto-Fill Fields

NORAD
Satellite Name
Date of Observation

Time of Observation
Site Name
Site Latitude
Site Longitude
Site Altitude
TLE File Name
T+Epoch
AOS
LOS
Duration of Pass
Maximum Elevation
Minimum Range
Timing Offset
Alignment Adjustment
Telescope Interface (e.g. LX200 or Autostar 497)
Satellite Tracker Version

User Input Fields

Other Remarks

Brent

DONE UP TO MESSAGE 220 - still need to incorporate some of this stuff in the manual

Message #2547 of 4527
Thru message 2625

I wrote a simple little program for a PC that reads the computer clock, waits for an even-second transition, and then sets the LX200 clock to the computer time via the same RS232 connection that is used by Brent Boshart's satellite tracker. You can download it from

ftp://ftp.frontier.net/home/ftp/users/powers_w - Requires a login
ftp://ftp.frontier.net/users/powers_w/ - still requires a login

The name of the file is synctime.exe. Public Domain.

For accurate setting of the computer clock, I use Paul Lutus' "AboutTime," available from www.arachnoid.com. It "pings" the time service to determine the delay, so should be right to a couple of milliseconds. When you come to think of it, light is SLOW. Only 186 miles per millisecond.

The program is short and dumb. It asks for a com port number (1 to 4), then a baud rate (9600 for the LX200), then tries to issue the clock-set command. If there's no connection you exit with control-alt-delete and end the task. Sorry about that. Don't use it when there's no connection.

Best,

Bill P.

Good, I gave the wrong address, so nobody got the program (the one I gave is for uploading and it requires a login and password, as well as being on my ISP's server). I have since had a conscience attack, and fixed up the program so that if there's no response from the telescope in one second, the program quits after saying "NO CONNECTION."

Sat Apr 7, 2001
I've put on my web site a freeware program which will allow you to set your LX200 date/time and site information from a GPS. Click the download link. I have only tested with the GPS that I own, a Garmin Emap but since it uses standard NMEA sentences it should work with many different GPS models. Hope you find it useful. It may be a good alternative to setting your computer and scope time in "the field" where you may not have internet access.

Brent

does your SW allow one to set LX-200 time and position from Satellite tracker or LX-200 control

Mine has one too. You can connect with the GPS, take your readings and then sync the computer time. Then disconnect the GPS, connect the LX200 and sync the time from the computer to the LX200, and copy the recorded Lat/Long info to the site information. In other words, both do not need to connect at the same time.

does your SW allow one to set LX-200 time and position from Satellite tracker or LX-200 control

No, not yet.

Q&A

Should one turn "Tracking" off in a goto scope while using Satellite Tracker to control the pointing?

important in my opinion is a very good 2 star alignment. ST will be telling the scope where to point several hundreds or thousands of times during a pass. If the alignment is off, the tracking will be off. It's harder to adjust left and right ( compared to the line of travel) than forward and backward in the line of travel. If the alignment is off, you'll be adjusting both all of the way through the pass.

You'll probably have to adjust during a pass, don't get me wrong, but the more you have right the easier it will be to do.

I may be wrong, but I THINK Sat Tracker works differently for the Meade LX200 that for Celestron scopes. I seem to remember reading that with the Meade, ST sends a succession of GOTO commands, and with the Celestron it varies the slew rates of both of the motors to try to match the movement of the satellite. If I am right, then adjustments might have different results wit the differentr brands.

In any case, with my Celestron, I have the timing offset steps set to .05 seconds - . The timing offset adjustment seems to jump ahead and then back up part way. If you have the adjustment set too high, you'll never get a satellite in the FOV for any length of time.

The other setting is set at .5. It's not unusual for me to run that one up 20 or more trying to get things centered.

The adjustments can be found under Options - Preferences - Timing Offset - fine adjustment is what is used with the joystick.

Make sure you save your settings after you adjust them.

Practice definitely helps, but it's hard to find one that moves like the ISS - low, fast and bright and always at an angle to the main compass points. Circumpolar sats are pretty easy to track, especially with a polar mount.

I'm debating which mount isa best for tracking - an alt-az or a polar mount. The jury is still out. I thnk the polar is easier, but haven't been able to see the ISS much since I switched to alt-az.

Sat Tracker guides an LX200 classic by sending a rapid sequence of gotos. It guides an LX200GPS/R/ACF by adjusting the slew speed. I'm not sure what it does with various Celestron models.

-John

If anyone's interested in EGP "16908 AJISAI" satellite, I have tracked it for 20+ minutes in 1 pass.
Here is a picture of the 7 foot diam disco ball.
http://wforacer. multiply. com/photos/ album/5#23

There are 8 geodetic (http://en.wikipedia .org/wiki/ Satellite_ geodesy
)satellites that I know of, here is the list:

EGP 16908 (by far the best)
Grace 1 & 2, 27391, and 27392,
Lageos 1 & 2, 8820 and 22195
Stella 22824,
Westpac 25398,
Sratlette 7646

Please post to the group if you see any of these sats, specialy any other than EGP.

Good Luck
Oz

>
> Knowing only time, my geographic location and RA and Dec. coordinates, is there
> a means of identifying a satellite in a ccd image?

That's enough data, assuming it's reasonably accurate (there are a lot of sats up there).
But Sat Tracker might not be the most convenient way to do this, since it's focused on driving scopes.
But there are many freeware "sat mapping" programs (which don't drive scopes) at
<http://astrotips. com>
If you find more than one possible candidate, direction, speed, and brightness can help narrow down the choices.

-John

It's usually best to not reset the timing adjustment when going from one sat to another on the same night, since much of the error is likely to be in your computer time. Of course, if you're tracking a recently boosted ISS, all bets are off.

Hard to say. Since that's perpendicular to the sat path, then if the new sat has a similar path as the old one, it might be best to leave it set from the previous pass. But if the new sat is moving in a very different direction, then the perp direction will also be different. Now most sats move west to east (more or less), but this adjustment is there to help if the scope alignment is off, and the error there can depend heavily on where in the sky you're aimed. So even if the new sat's path is parallel to the old one, but displaced across the sky, the old adjustment could be wrong for the new sat.

-John

Only 2 things affect the ISS Monitor in the right panel of Satellite Tracker.

UTC and the ISS TLE

An incorrect Latitude and Longitude for your site does not affect the ISS Monitor but will give you incorrect times to look up and see the satellite.

Hello Matthew

This should be an easy fix.

Only 2 things affect the ISS Monitor in the right panel of Satellite Tracker.

UTC and the ISS TLE

An incorrect Latitude and Longitude for your site does not affect the ISS Monitor but will give you incorrect times to look up and see the satellite.

Let's check UTC first.

Start SatelliteTracker
Click "Reset Filters" button
Un-Check "List by NORAD"
Click "Refresh List"
In the drop-down to the right of "Refresh List"
Click "ISS (ZARYA)"
ISS information should display in left panel.

Look at line 6 and 7
Local time:

UTC Time:

Local Time: is your PC time

If your "UTC Offset hours" (EDT = -4) is incorrect the
UTC time will be incorrect.

I think you said you were in EST.
We assumed you were saying Eastern Standard Time, not
Europe Standard Time. Correct?
Europe would be +2 or +3

Heavens-above has your time under Miscellaneous
Click "What time is it?"

http://www.heavens- above.com/

If the UTC is incorrect, change your "UTC Offset hours" until the UTC is correct.

If you have adjusted the time in SatelliteTracker and want to reset back to PC time.
Click the "Set" button at top center.
Click "Reset to System"

Second, Let's check your ISS TLE

With the "ISS (ZARYA)" selected and displaying in left panel.

Click "TLE Data" button at top left

Look at line 6 and 7

Epoch Year
Epoch Day

This is what I see

Epoch Year 09 represents year 2009
Epoch Day 162.529 Represents day 162 of year 2009 (June 11, 2009)
.529 X 24 = 12:42 UTC
My ISS TLE was observed on June 11, 2009 at 12:42PM UTC

If the above UTC and ISS TLE are correct
Uninstall SatelliteTracker
Reboot
Re-download setup.exe and sat.exe from the files section

http://f1.grp. yahoofs.com/ v1/oLYxSvfPn6ybE bEHw8PSK42188_ dHHWns4P5Ox7HbWs
I7IzqVusgJsepL4w ULdakDgY70hETgy5 6xJjbXqeWPS0WiY2 e0R5_s3Q/ setup.exe

http://f1.grp. yahoofs.com/ v1/oLYxSt3FUVebE bEHBcLEBPbe3Ts_ wKhxI10orx4CRvvf pexphwZYipVID6K0 _GHamRyJWDGgVGKJ I9kPD6yTFXXc32iq hVX353Y/SAT. EXE

Re-install SatelliteTracker and download new TLE's

Jimmy

- - - - - - -

Hmmm, that brings up a god question, group. When DOES one need to refresh the list? What is it refreshing?

Folks:
> Newbie here. In the ST screen, when you select a direction from the filter list, are you selecting the direction that the sat will be going or the general compass direction from which it will first appear. IOW, if I select SW, will I expect the sat to first appear in the SW sky or is SW tha direction that I can expect the sat to be "flying"? Help appreciated.
> Rich.
>
I've wondered that too...I click a south direction Sat., then pull up the world map on it,you can tell the direction it will pass to you..when its above the horizion you can click sky map, an get even better idea of it pass..last thing i look at is the Height of it,i try an stay inbetween 500km an 1000km with a 8" scope,Enjoy! Clear Sky's!

Bozo

The entire orbital plane of the IS will be in constant sunlight from
roughly 9 utc ( July 6 ) until 7 utc ( June 10 )

So between the above times, the ISS won't pass into the earth's shadow. Before the above times, the iss will pass into the earth's shadow, and so for some of the pass, it disappear's from view.

So get ready, to see the iss pass by a couple times during the night, are the marathon as we like to call it.

The toolbag marathon occur's before the ISS marathon, because the orbital plane with align with the earth's twilight zone, before the iss orbital plane does.

Please note, this event is for people in the northern half of the earth.

Enjoy the marathon.

Kevin

Kevin Fetter" <kfetter@... >

> Before the above times, the iss will pass into the earth's shadow,
> and so for some of the pass, it disappear's from view.

That should be, before 9 utc ( July 6 ) and after 7 utc ( July 10 ) the iss will pass into the earth's shadow, and so for some of the pass, it disappear's from view.

Hi John,

Because of the tilt of th Earth's axis (to which the ISS's orbit is matched) the pattern of northern and southern terminator crossings will only be "mirror images" of each other at the equinoxes. At midsummer in the northern hemisphere and midwinter in the southern (or vice versa) the patterns will be at their most dissimilar.

Andy

--- In satellitetracker@ yahoogroups. com, John Mahony <jmmahony@.. .> wrote:
>
>
> There's something I don't understand here: if this is happening because the orbit matches the earth's terminator during this period, shouldn't the same thing be happening in the southern hemisphere at the same time?
>
> -John
>

This might be the answer?

I drew the Earth with north south poles, equator
Sun above Tropic of Cancer (23.5 degrees)
Earth terminator inclined to Sun at 90 degrees = 23.5 +90 = 113.5
ISS orbit inclined to equator at 52 degrees.
180-52= 128

128 - 113 = 15 degree tilt between orbital planes.

The ISS orbital plane and the Earth terminator plane are tilted from each other by about 15 degrees.

Example:

During July 6-10, 2009,
The ISS orbit when in the Northern Hemisphere will be on the dark side of the Earth and tilted about 15 degrees into the dark from the terminator.

45 minutes later the ISS will be in the Southern Hemisphere but tilted about 15 degrees into the light from terminator.

The Southern Hemisphere does not see the July ISS Marathon because they are in the daylight when the ISS goes over.

Dec 2-3, 2009 the reverse will be true and the Southern Hemisphere will get to view the ISS Marathon.

Jimmy

I just came to the same conclusion myself, when I realized that the inclination of the ISS orbit wasn't enough to make it line up completely with the terminator even at the summer solstice.

-John

Indeed the ISS is in sunlight for the whole orbit between about orbits #60900 and #60956 (2009-July-06 to 2009-July-10) . That's called "beta cutout" by the NASA and has prolongated the next STS-127 attempt until 2009-July-11 due to shuttle thermal considerations.

Rainer

No, not directly.? It is possible, however, using the EQMOD freeware, to apply Satellite Tracker to the SynScan/SynTrek based mounts.

You'll need to head over to the EQMOD Yahoo! group and study the package.?

http://tech. groups.yahoo. com/group/ EQMOD/

It will take downloading and installing?the EQMOD package, ASCOM driver set from the ASCOM Standards site, a planetarium program, EQMODLX package, HW Virtual Serial Port freeware, Satellite Tracker, a physical adapter to convert the RS232 serial output to TTL (sold by Shoestring as EQDIR) and?a serial cable in place of the hand controller, a serial to USB converter if you don't have a serial port on the computer, maybe more I'm forgetting.? A great number of the USB2Serial converters will not work; the Yahoo! EQMOD user group has a data base of what works and what doesn't.? It is possible to get around the EQDIR and straight serial cable from the computer to the

mount head with the SynScan V3.25 firmware version and running the upgrade cable from the computer to the hand controller.

It isn't easy, but it can be done.? Instructions/ guidelines are on the EQMOD Yahoo! site.? I've been using it for about three years on an Orion Atlas EQ-G mount, same innards as the Sirius.

The problem is that the Satellite Tracker commands are structured for the LX series of mounts; the whole EQMOD/EQMODLX package is needed to convert the mess into ASCOM compliant directions.

Jim

-----Original Message-----
From: boycebruce75 <boycebruce75@ yahoo.com>
To: satellitetracker@ yahoogroups. com
Sent: Wed, Jul 8, 2009 1:24 am
Subject: [satellitetracker] Satellite tracking with an Orion Sirius mount

I'm interested in tracking sats with my Orion Sirius GoTo mount - can the Satellite Tracker S/W I downloaded from this site be used to drive my mount? I don't see Orion mounts listed as options when I run the S/W. Thanks.

Focal plane distance for various objects (formula)
http://tech.groups.yahoo.com/group/satellitetracker/message/3809?threaded=1&l=1

I can think of 2 variables.
>
> Fuel remaining for a re-boost by shuttle is determined by launch time in the launch window. I think the middle of the launch window uses the least fuel to achieve rendezvous.
>
> Second Altitude change during a re-boost is related to Shuttle burn time and mass of ISS.
> It now takes a longer burn time to achieve the heigth of earlier years due to a more massive ISS.
>

Good thoughts Jimmy. As the ISS gets heavier the boost gets harder. I also noticed in one of John's links that:

"The ISS is maintained at an orbit from a minimum altitude of 278 km (173 mi) to a maximum of 460 km (286 mi). The normal maximum limit is 425 km (264 mi) to allow Soyuz rendezvous missions."

Apparently the Soyuz limits how high they can fly.

Leo Taylor

Re Boosts:
After the iss orbit is changed, the ISS has to pass across the tracking network, so the sensor's can get positional data, to update the data.

After the launch a new geo sat, the satellite will change it's orbit over time, in order to get to the proper orbit. Again the sensor's have to pick it up, after it's move, so a updated orbit can be computed.

It takes time, to do that.

Kevin

As mentioned in those messages, the space-track TLEs are based on actual observations, while the NASA predictions are predictions. The algorithm for adjusting the TLE from observations isn't specified, so this could be some generic attempt to match a TLE to observations, in which case it would take a good number of observations (probably at least a few orbit's worth, if there are a few observations per orbit) before the TLE catches up with reality. In other words, the algorithm may be designed to correct for normal minor things like gradual orbit decay from atmospheric drag, and the deliberate boosts essentially throw a monkey wrench into those equations.

NASA, on the other hand, knows how much thrust they put into the boosts, so they can do their calculations based on that specific "disturbance" to predict the resulting orbit.

-John