General instructions for setting up any equatorially mounted telescope.

Well, congratulations are in order, you have bought a precision instrument from SCS Astro. Let's be serious, this is no toy (unlike some "telescopes" you can find elsewhere), this is the real thing. It will bring you years of enjoyment as long as you take good care of it. The first good thing is reading this manual. It is hoped that by the time you reach the end you will know a little about telescopes. The correct way to assemble the telescope, the use of the accessories etc., is important. If there are any points that you are unsure of, then talk to us. We're here to help.

First of all, don't be in a rush to erect the telescope, take your time, and if necessary, involve or seek the advice of a fellow amateur astronomer. Some astronomical resources are mentioned towards the end of the manual. Normally, there is a local society near you and you may get the address of it's secretary from your local library.

Read this manual and the telescope instructions first. This is very important, because without knowing what to do, you may damage the telescope. The telescope has glass optics, and glass can break if you are not careful.

Check what you have in the box. Read the delivery note and look inside the box to make sure you have all the items that normally come with the telescope, and the items that you may have specifically ordered (i.e. Motor Drive), and that they are not damaged in any way. You must tell us immediately if there is any damage to the instrument (or any of it's components) that may have been caused during transit. Do not throw the packaging away.

Once you are satisfied that everything is OK, then erect the telescope following the instructions carefully. When erected look around the telescope with the aid of this manual. And that's it!. Once you have practised the assembly and dis-assembly of the instrument you will be able to take it out and look at the wonders of the night sky!

But read on! we have not finished yet! In the following pages you will find out how to use the telescope and get the most out of it. This manual will deals with the Voyager Telescope Systems (both reflector and refractor instruments) and will show various things, like using the accessories correctly, the function of the equatorial mount and other situations that may need to be considered. This manual was written by an amateur astronomer with beginners in mind (remember, we were all beginners once!). But even if you are an experienced astronomer then keep this book handy.

THE TELESCOPE - HOW DOES IT WORK?

This part of the manual will give you a better understanding of the equipment you have purchased

There are two types of telescope used by astronomers, the refractor, and the reflector. Both telescopes have advantages and disadvantages. It really depends on what you want the telescope to do. Telescope means "to see things distant", and what it does is make an image of the object we wish to look at, and we view the image with a special type of microscope which we call the eyepiece. The opening at the tope of the telescope is the all important factor, which is known as the aperture. The size of the aperture tells you how much light we can get to see the object. The more light, the better. The refractor uses a lens which refracts or bends the light to form a focus while the reflector uses a mirror to do the same job. First, let's look at the refractor in more detail.

THE REFRACTOR

The refractor uses a glass lens to focus the image down at the other end of the telescopes. Refractors have a fixed lens which really does not need any servicing whatsoever, with the exception that you must clean the dust off from time to time. They are normally long with the light travelling directly down the tube to the eyepiece. The main lens, or Objective, must be very precisely made, using certain type of glass or the image formed would be horrible to look at. The eyepiece end, or focusing mount, normally entails a rack and pinion system to gently move an inner tube holding the eyepiece in order to get the correct focus, by using thumbwheels at either side, and obtain a clear, sharp image. Near to the focusing mount is the Guide Scope, a small, but extremely wide field telescope with a recticle (cross-hair) on the inside so you can initially "target" an object that you wish to see. This must be aligned with the main telescope and can be adjusted by 3 set-screws. The screws can be fixed in their positions by turning the screw-locks on each screw. The refractor has be the advantage of being relatively light, easy to use and requiring very little maintenance. The normal size of refractor is 80mm (3 inches) which is classed as about the best for normal observation of the sky. It is normally assumed that an 80mm refractor is equal to a 150mm (6 inch) reflector. The refractor can be used for solar,

lunar, planetary and some bright nebulae (gas clouds). Refractors over 100mm (4 inches) are very good for fainter nebulae. The lens of the Voyager refractor are achromatic, or colour free lenses, which are made using two types of glass to make sure colour fringing (chromatic aberration) is greatly reduced.

THE REFLECTOR

This type of telescope, as said before, uses a special mirror to focus the light and has another mirror, further up the tube, to 'knock' the light into the side of the telescope where the focusing mount is situated. With an eyepiece in the focusing mount, you can then view the image. In both the refractor and the reflector, eyepieces are separate items which can be removed to change the magnification of the object viewed, and are normally held in the telescope by a thumbscrew or other device. The reason that these types of telescope are popular is because of the possible large mirror sizes, enabling more light to be collected. But there is a note of

caution here, in that you must take greater care of it. The primary mirror has a special curve ground into the glass, which is then coated with an extremely fine film of metal, normally aluminium, to make the reflecting surface. This is what make the light come to a focus. The mirror at the top of the tube (called the secondary or flat) puts the light out to one side, and is also ground flat to very high tolerances.

Never touch the surface of any mirror with your fingers.

It must be noted here that the coating will degrade with age, but if you look after the telescope no maintenance will be needed for some considerable period of time.

THE MOUNT

Your telescope comes with a type of mount which allows you to track a celestial object through the night sky. This mount is called an Equatorial, and your mount has drives which allow you to adjust the position of the telescope with ease and, when properly set-up, keeps the object in the centre of the eyepiece. This mount is extremely useful, and cuts out a lot of unnecessary wasting of time by having to re-position the telescope to keep track on the object. Another type of mount is the Alt-azimuth, which is a simple design, in that it has two paths of movement, one up and down, (altitude), the other 360 degrees around the horizon (azimuth). This mount is good for terrestrial use, and is used on some astronomical telescopes. But there is a limitation. The stars, planets, Moon, etc., follow a path which is more of a curve. When a star rises in the east it does not go straight up, but at an angle. this angle would require anyone with an Alt-azimuth mount to move up a little in altitude and around in azimuth by a small amount. Thus, you are moving in two axes. Some of these mounts have micro-adjustments attached so the process is better performed, and many people use these mounts for serious observing.

The equatorial is a mount which allows you follow any night sky object with ease. it is a mount which, when one axis is pointed towards the north celestial pole, the other will maintain a position on any object set in the telescope, or found by using the graduated scales attached to the mount called setting circles. The mount may also have worm gear drives attached, called slow motion drives, which are turned by using a thumb-wheel, to which extension arms could be attached for ease of use. This mount is standard on the Voyager telescopes. Once properly set up, you only have to move the telescope on one axis only, normally the polar axis. This mount has the telescope at one end of a rod which has a weight, or counter-balance attached, which allows you to correctly balance the telescope for use.

The setting circles relate to a form of “map reading” in the sky. The scale on the polar mount is called Right Ascension (R.A.), and the scale on the telescope and counter balance rod is called Declination (Dec) . If you can work out positions of places on a terrestrial map then using the circles should not present to much of a problem. It you look in a star atlas, like Norton's 2000, you will find maps with all stars down to naked eye visibility (Magnitude 6). You will also notice lines going across and up and down the page. The lines going up and down, are the Right Ascension. and the lines going across are the Declination. The Right Ascension lines go from 0 to 23, relating to 24 hours. Each of these hours are split up into “minutes” and depending on the accuracy of the star atlas used, the minutes are split into “seconds”. Each hour or R.A. represents 15 degrees (24 times 15 equals 360)
Most stars are plotted on these maps with relation to R.A. and Dec. The star Vega is plotted on a map as R.A. 18h 36 min Dec+39. Vega is a star in the summer sky and is quite bright and easy to see, even in a town which may be light polluted. Once the telescope and mount have been correctly set up, and the mount set as accurately as you can towards the Pole Star, (please note that the pole star, Polaris, is about a degree away from the actual north celestial pole, and thus a small error may be induced over a long period of time), you can train the telescope towards a star on known R.A. and Dec and adjust the setting circles accordingly. Thus you will be able, depending on the accuracy of the scales, to find objects by using a star atlas. Full details of how to adjust the setting circles will be explained in Using the Telescope.

EYEPIECES

Eyepieces are the other extremely important part of the telescope. They are normally small cylinders containing much shorter focal length lenses. They come in many types, but the ones you have with your telescope are of Kellner design, which is a low cost form of good quality eyepiece to start with, and are much better than some other forms of eyepiece supplied with High Street sold telescopes. It is recommended that you try to obtain eyepieces called Orthoscopic, which are a universally useable eyepiece, being of good colour correction and optical quality. The focal length of the eyepiece is an important part of the equation in finding out the magnification obtained. To find the magnification just divide the focal length of the telescope (lens or mirror) by the focal length of the eyepiece, (example: 1000mm divided by 20mm = 50 or 50 times or 50X). The focusing mount has an aperture which allows an eyepiece to be inserted and locked into place by means of a thumbscrew. You can look through the eyepiece, and see what you wish to observe. The eyepieces that come with your telescope are made of metal, but, beware some eyepieces, especially the cheap eyepieces like Huygens, Huygen-Mittzenway, in which the lens holders in the eyepieces (cells) can be made of plastic and can be easily damaged if used to observe the Sun by projection.

Do not touch the lens surfaces, or interfere with a lens assembly

Some eyepieces can only be used on telescopes of a certain focal length (Orthoscopic can be used on any telescope). It depends on how fast the telescope is. This is a term used by photographers to indicate how much light the optical system can gather. This is also known as the focal ratio, and is found by dividing the size of the objective lens or mirror by the focal length. Using the Voyager 90 as an example, with a focal length of 1000mm and an objective diameter of 90mm (1000mm divided by 90mm = 11.11) or f11. If you have a telescope f10 or less then you will be able to collect a lot of light and obtain fairly wide fields of view. But magnification would be low. On the other hand, over f10 would allow fairly high magnifications but the light gather capability would be low. Cheaper eyepieces such as the Huygens, or Ramsden, can be used on telescopes of high focal ratio only.

It is normally recommended that you only use 50X magnification per 25mm of aperture, so a Voyager 90 would have an optimum magnification of 150X, under perfect seeing conditions.
Remember, on a reflector the area in the centre of the telescope is obstructed by the secondary mirror mount (spider) so you would lose a small proportion of light that way.

ACCESSORIES

With the Voyager telescopes accessories will be included in the package. Other instruments and add-ons can be obtained as optional extras. Accessories include eyepieces, filters, motor drive and the Barlow lens.

The star diagonal is a necessity with a refractor in that when the telescope is placed in a position straight up, or other angles, the eyepiece may be in an awkward position and sometimes inaccessible to view, so by adding this piece of equipment, it will allow you to view object with better posture. The diagonal is a mirror or prism which, like the secondary of the reflector, when placed between the telescope and eyepiece, knocks the incoming light at an angle of 90 degrees and into the eyepiece.

An other accessorie you might obtain is the Barlow lens, which is a concave or negative lens which allow you to increase magnification by 2 or 3 times, depending on the type obtained. So by replacing the eyepiece with a Barlow and then putting the eyepiece into the aperture at the front, you can effectively double or triple the magnification of the eyepiece, i.e., a 20mm eyepiece with a two times Barlow would act like a 10mm, etc. But it is recommended that you only use this equipment on fairly bright objects, such as the Sun, Moon and the Planets.

Eyepieces normally come in two sizes, 24.5mm and 31.7mm. The former is a small eyepiece which is standard in most High Street telescopes. The ones issued with your telescope will be 31.7mm, which are better. Other, better, eyepieces can be obtained from SCS Astro in the same format. The 31.7mm is the normal telescope eyepiece size used by amateurs, and the 31.7mm relates to the outsize diameter of the barrel which is placed into the telescope. Your telescope will accept either of these two models, unless where specified, and may require the use of a different eyepiece adapter which can be obtained as an optional extra from SCS Astro. The eyepiece setscrew is turned to lock the eyepiece in. Always ensure that the eyepiece is firmly locked into the adapter before use.

A good book on Astronomy is always recommended and some ideas are given at the end of this manual. Never buy a book that is too hard for you to read, and better still, go to your local lending library, as some astronomical books are quite expensive. Try to join a local astronomical society or join the Society for Popular Astronomy or other similar society, as being in contact with people with the same interest is always enjoyable. Some addresses are given at the end of this manual

Next, we will go through the motions of erecting the telescope after delivery.

SETTING UP YOUR TELESCOPE

Remember, read these notes carefully. Make sure that you are prepared and do not rush the job. You may need several “rehearsals” of setting up and dismantling your telescope before you use it.

Arrival instructions

The box has arrived via the couriers. Please remember to open the box with great care, as use of a knife may damage parts. Carefully, open the box to reveal the contents and then remove the contents, checking them off with the parts list inside. It is vital that any defects or damage are notified to SCS Astro within 3 days of receipt. Unwrap optical parts carefully and lay them to one side. Once you are satisfied that all is well then continue on as follows. Do not throw the packaging away.

Tripod

The tripod is erected by undoing the setscrew on each leg and allowing the inner leg to come down to the end. Then, retract the inner leg about 25mm and lock off. Stand the tripod on the ground

Equatorial head

The equatorial head is normally fixed on the tripod as standard. It should not move at all. The head can be moved in azimuth by turning. Turn the screw in the tripod head until the head can be turned and set to the required position. Re-lock using the lock-screw.

Counter-balance weight and rod

The counter-balance weight should be fitted over the metal rod and locked into the centre position of the rod. The rod should then be screwed into the equatorial head and firmly tightened. Care should be taken not to drop the weight so you could damage yourself, other persons, animals or equipment. You may notice that the weight may be moved up or down so to help balance the telescope for use, make sure that the weight stop at the end of the rod is secure.

Attaching the telescope to the mount

The telescope must be attached to the mount via the use of two brackets supplied. Screw each bracket to one end of the equatorial mount head and screw tightly. The brackets are opened by undoing the lock-screws on each bracket. Place the telescope tube and optics carefully onto the brackets, around the mid-section of the tube. Holding the telescope on the brackets, close the bracket(s) and lock in place by tightening the screws. Your telescope setup is essentially completed.

Finderscope

The telescope comes with a 6X30 (6 times magnification, 30mm objective lens) finder scope with a “crosshair” recticle to allow initial sighting of the telescope to the object that you wish to view. Attach the Finderscope carefully using the screw provided to the

main telescope. If the Finderscope is not attached in it's mount, then release the three finder scope set-screws fully and place the tube and optics into the holder, then carefully bring the three setscrews down until they touch the finder and then leave, Make sure the finder is secure in it's mounting and will not fall out. It is then not normally necessary to take the finder scope off the telescope again.

Check the erected telescope for damage and look (but do not touch) the objective lens of the main telescope and lens of the finder. If these are damaged then get in touch with SCS Astro straight away. Look down the main telescope tube without an eyepiece and make sure all is clear that way.

The movement of the equatorial mount is important when observing, and damage can occur if the telescope is not correctly balanced. Unlock the polar axis of the mount, using the special key provided, and check the movement of the telescope. Make sure that it is smooth, then re-lock and turn the slow motion drive wheel and check the movement again. You will notice that the Right Ascension scale will move as well, this is normal. The Declination axis holding the telescope and the counter balance can be moved and you must check the balance of the mount by moving the counter balance weight up and down to make sure the telescope is correctly balanced. A correctly balanced telescopes will move, when unlocked, by the light touch of a finger, and will stay in the same position without moving. The telescope must also be balanced, and this is achieved by loosening the telescope tube brackets slightly until you can move the main telescope forward and backward, until it does not move when lightly pushed by a finger. When satisfied then re-tighten the screws. Check the smoothness of the declination movement, then lock and use the Declination slow motion drive to check the drive movement. It must be noted here that the Declination scales are fixed and cannot be moved.

Under no circumstances should any telescope axis be moved, when locked, by any means other than the slow motion drives.

Taking one of the eyepieces, check the eyepiece for damage, then place it into the eyepiece adapter on the focusing mount. Once inserted you can then lock off using the setscrew, making sure it will not fall out.

Through a suitably placed open window (do not look through window glass with the telescope) unlock the equatorial, using the key provided, and then point the telescope at a suitable distant object, like a church spire, electrical pylon, telegraph pole or TV aerial, and lock the telescope on it. Looking through the telescope, get the object viewed better positioned by using the slow motion drives (do not attempt to force the telescope) then, by using the thumbwheels on the focusing mount, carefully rotate the wheels until the image comes into focus. If the focusing is too “easy” then turn the screw on top of the focusing mount to increase the tension slightly (Note: this is NOT a lock). Keeping everything as it is, this would be a good time to line up the Finderscope with the main telescope. Unscrew slightly each of the three set screws on the finder mounting until the finder tube is loose, then by rotating each screw try to bring the centre of the crosshair onto the same point as in the centre of the field of view of the main telescope. This may take a little time and patience to do, but it is well worth it. Once you are satisfied that the crosshairs are positioned correctly then lock the set-screws in their positions using the fixing nuts. After this you will be able to use the finder to point at an object and it will be visible in the main telescope. last of all, unscrew the eyepiece tray and place in the centre hold of the tripod struts. Replace the screw and lock.

And there it is, your Voyager telescope should be ready. Now lets hope for a clear sky and get the telescope observing night sky objects.

Care should be taken when transporting the erected telescope to a site in the back garden, and as you don't want to knock anything over, like the best flower vase, keep a good eye out. The telescope can be dismantled into three main parts. First, the telescope tube and optics. Second, the tripod and equatorial head. Third, the counter balance weight and rod. This might be better for moving things around the house, and with practice you can erect the telescope in a very short time. When dismantled though, try to place everything back into the box as best you can. Unless you have made or obtained something better, keep all the boxes and wrapping that came with the telescope.

Also, make sure all caps are used to keep the objective and any other open ends free from dust, etc.

Erecting the telescope on the outside is very similar to your initial setup. Let's now assume that the telescope is erected outside. We can now go through the pre-observing procedures.

USING THE TELESCOPE

This is it! The time that you will actually look through the telescope and do some observing (weather permitting, of course). Observing with a telescope or other optical device needs care and attention. You need to be patient, familiar with the working of the instrument, and familiar with the rest of the other equipment supplied.

If you have practised setting up the telescope at home in daylight, then setting up in the dark will be fairly easy. Using a white light torch to get everything set up can be a necessity, but when the telescope is ready, switch all white lights off!, This is because you have to allow your eyes to get accustomed to the darkness around you. This is called dark adaptation. You will see better through the telescope when you have properly adapted to the darkness.

Be aware of where things are! This is due to the fact that any hazard may be invisible to your eyes and walking around may be hazardous. If you are in the garden, watch out for washing lines, small walls or steps, etc., and be careful of where you have put your telescope and accessories, as you may lose equipment by dropping them accidentally. Always warn people of your presence if they are coming towards you. Use the eyepiece tray.

If you take your telescope out of your house, flat, garden, etc., always make sure that you are accompanied with a friend or person you know, especially is isolated spots. It is best to join an astronomical society and go observing with them.

First, we have to make sure that the equatorial mount is correctly positioned. The equatorial mount, is attached to the tripod by a bolt. This bolt can be freed slightly and an adjustment made up or down depending on your latitude. The bolt can be freed by turning slightly and carefully, the lever at the side. On the opposite side there is a scale made like a protractor. This should be set to your latitude which is dependent on where you are in the United Kingdom. London is around 51 degrees. A good way of obtaining your latitude is to find the pole star and point the polar axis at this star. The telescope should be set to 90 degrees on the declination setting circle (the objective lens will be pointing towards the pole star) and then the telescope would set so the telescope is parallel to the polar axis. Then point the telescope at the pole star, adjusting the WHOLE telescope so that the star will be to be seen in the main telescope. If you have correctly pointed the telescope at the star, then the polar axis will also be in the correct position. A good test for this is that by locking the Right Ascension and then turning the telescope using the RA slow motion drive, there should be little or no movement of this particular star.

Right, let's balance the telescope now, unlocking the axis screws and adjusting your telescope so that the balance is correct. An incorrectly balanced telescope could cause damage to the bearings of the RA and Dec later on. Check the balance of the telescope with your eyepieces and/or any other equipment on. Also, adjust the counter balance and the balance of the tube and optics regularly.

The setting circles can now be set, and the use of a good star atlas would be of a great help here. First of all, find a bright star of a known RA and Dec. Point the telescope at this star, making sure that you have unlocked the RA and Dec locks. Assuming you have put an eyepiece in the telescope, have found the star in the eyepiece, lock both axis bolts and then using the RA and Dec slow motion drives place the star into the centre of the field of view. The star, on an un-motorised mount, will move across the field of view in the eyepiece, so you will have to be quick in making sure the RA setting circle is correct, and adjustments will have to be frequently made to make sure the star is in the centre of the field of view.

The Declination scale is fixed and cannot be moved. The Right Ascension scaled can be moved around by hand or by the slight unscrewing of a small bolt in the side of the polar axis. The declination angle should read the correct declination of the object in view, but the RA reading will have to be adjusted to the correct reading. The numbers on the RA read from 1 to 24 (meaning hours) and you should read it like a clock with the intermediate graduations being minutes. Adjust the RA scale to the correct RA as per the star atlas so the co-ordinated are that the pointer on the polar axis. Lock the small screw and then the circle will be set so you should be able to read the co-ordinates from a star atlas and find a particular object of interest. This procedure may take time and patience to do, but once you have set the circles correctly, you should not have too much of a problem finding any object above your horizon.

Look in the sky for a subject, then by looking through the small finder scope, which should be set as accurately as possible to the main telescope, point the telescope at this object. Once the object is at the intersection of the two crosshairs it should be in the field of view of the main telescope.

Lock the axis screws and then by using the slow motion drives (with the extensions on if necessary) place the object in the centre of the field of view. Then by turning the thumbwheels on the focusing mount bring the object into focus. It is recommended that you use the low power first and then change the eyepiece later if you require a higher magnification.

Use of a small red light (not too bright) is very useful as red light does not destroy dark adaptation and allows you to see things a bit better. But only keep it on for as long as necessary.

Be very careful to make sure that you tighten the eyepiece screws so that the eyepiece will not fall out.
Barlow between the diagonal and the focusing mount.

OBSERVING

When observing, the use of a good star atlas may be useful, and of course, if you are observing with other astronomers, the more experienced ones will try to help you. Try to write down what you see, make a log of your observations. Try making drawings of lunar craters or bright nebulae (such as the Great Orion Nebula). Note down the time, date and location of your observation. Write down a little about the subject you are looking at. Try to keep the log ongoing.

What's out there?

Looking at the sky is great fun, and the more knowledge you have, the easier it becomes. Invite your friends to look through the telescope. But also tell them to be careful and that they have now need to touch anything on the telescope (with the exception of focusing), just look through the eyepiece. People with glasses can adjust the focus so they do not have to look through their glasses in to the eyepiece. Tell them not to touch the lens (or mirror) surfaces and be careful not to 'kick' the tripod (which means you will have to align the telescope assembly to Polaris again).

The Sun

We will have to be very careful here.

PLEASE READ THE WARNING BELOW:-

NEVER LOOK OR STARE AT THE SUN WITH THE NAKED EYE, OR THROUGH ANY OPTICAL INSTRUMENT (TELESCOPE OR BINOCULAR) WITHOUT PROPER FILTERING. DO NOT ILLUMINATE MICROSCOPE SPECIMENS BY MIRRORED SUNLIGHT. DO NOT USE POLAROID, COLOURED GLASS, OPAQUE PLASTICS, DARK GLASS OR SMOKED GLASS TO LOOK AT THE SUN. STRONG INFRA-RED RADIATION FROM THE SUN MAY CAUSE PERMANENT DAMAGE TO THE EYES. DO NOT USE EYEPIECE HELD SUN FILTERS AS THESE COULD CRACK UNDER CONTINUED SOLAR OBSERVATION. DO NOT USE TELESCOPES WHICH HAVE PLASTIC PARTS AS PART OF THE OPTICAL MAKEUP FOR SOLAR OBSERVATION AS DAMAGE COULD RESULT.

The Sun is the only dangerous object in the sky. The light and heat could cause damage to your eyes or your telescope. If you have a telescope which has a metallic structure you can use this for projecting the image of the Sun onto a white surface, such as a piece of white paper. This is a safe and easy way to observe the activity on the Sun's “surface”. You may, when projecting the image, see dark spots which are the famous sunspots. ONLY PROJECT THE SUN, and only use direct observation once you have been instructed in the correct way and have the required filtering on the telescope. Good solar filters are expensive and require care. it is recommended that you do night sky observing until you can lean how to observe the Sun properly and above all, safely, from an experienced solar observer at an astronomical society.

The Moon

This will probably be the first object you will see in your new telescope. if you view the Moon at half phase a splendid sight will be seen. The Craters, cliffs, mountains, low lying areas, etc. can be seen in very sharp contrast. During Full Moon few craters can be seen, except for the ones which show impact ejecta (or rays) emanating from them. One such crater is Tycho, which is a very prominent ray crater to the South of the Moon. When it is full, the Moon appears very bright indeed, and you may need to use a Moon Filter, which can be bought as an optional extra from SCS Astro. This is a piece of green glass, to cut down the glare. But the best times are during the waxing part of its orbit or first 14 days towards full moon. The phases will start as a crescent which will low in the western skies shortly after sunset, then each day the phase will increase and the object will climb higher, getting brighter as it does so. After Full Moon the Moon will rise much later and may only be seen during the morning hours (Waning).

During a full moon there may be a partial or total eclipse of the Moon, when the Earth's shadow may block out the Moons light causing it to get darker and darker until it becomes very dark or has a bright re-orange colour.

You cannot see the New Moon as it's shadow will be facing the Earth and will be invisible, unless it crossed the face of the Sun, when we have a Total Solar Eclipse. A total solar eclipse will occur on August 11th, 1999 in Cornwall. Partial eclipses occur as well.

The Moon is a wonderful object to look at and will, no doubt, be one of your favourite objects to view.

The Planets

With your Voyager 90, you will probably see, during your observations, Venus, Mars, Jupiter and Saturn. Neptune and Uranus can be seen, but only as disks. Mercury is so close to the Sun than we can only see it at certain times of the year and then, you need to know where to look.

The brighter planets can easily be seen, and you may also notice that they move within a band of 12 constellations called the Zodiac, i.e., Jupiter's orbit is 12 years to go once around the Sun, so will appear to travel from one constellation to another approximately once a year.

Venus is a very bright planet, and because it is closer to the Sun than Earth it will show a phase, like the Moon, on occasions. It is very bright because of it's atmosphere, which reflects a great deal of the Sun's light. It is a very good target for your telescope. Do not look for the planet when it very close to the Sun.

Mars is the red planet. Your telescope should reveal some markings on the surface depending on how steady the night sky is (our Earth's atmosphere moves and so causes night sky objects to twinkle). But you will really notice it's colour.

Jupiter is the largest planet in the Solar System. it is a bright planet and a joy to look at through a telescope. When it is around in the night sky you will be able to see the planet easily under low power. Higher power will reveal the cloud belts and possibly the Great Red Spot. The other thing you may notice, is that Jupiter has four large bright moons going around it. Io, Europa, Ganymede and Callisto respectively. These moons circle Jupiter at different rates and you may see them move or disappear/reappear from behind Jupiter's disk.

Saturn is the lord of the rings. This fairly bright planet sports a wonderful set of rings. These rings change in size depending on where (the planet) is in it's orbit. There are times where you cannot see them at all!. It is a wonderful sight in a telescope.

Comets are wanderers, which may come from the depths of space or have orbits within the solar system. They are really rocks which are coated with a layer of dust and ice (like a dirty snowball) and when going around the Sun, give off large tails. When a bright one comes along, it is a good observing target using low power eyepieces.

Photography is possible with your telescope. You may try putting your camera on top of your telescope so that you can take constellation pictures or long exposure photography, or you can obtain a optional camera adapter to take pictures of the Moon, or other object, through the telescope. Optional extras are explained elsewhere in this booklet.

If you have any queries then call SCS Astro and we will try to help you.

OPTIONAL EXTRAS

Buying other equipment for your Voyager or any other telescope is easy. Call SCS Astro for our lists of equipment. You do not have to buy these straight away, but other items of equipment could be useful later on. Some of the extras are explained below:-

Camera Mount

This is an essential item if you plan to do serious astrophotography through your telescope. The mount is le a long tube, which you place in the focusing mount, and lock on. By using various 'T' mounts on SLR cameras, you can screw the camera firmly onto this

mount. An eyepiece is normally placed inside the main barrel and locked inside with a screw. The camera is attached on the telescope and magnified photographs can be taken. By unscrewing the barrel, and removing the eyepiece adapter, you can screw the camera onto the telescope to get “prime focus” or pictures of any object by using the main telescope as a telephoto type system.

Filters

Filters are useful for observing. There are many types and they normally screw into the eyepiece before placing the eyepiece into the focusing mount. This easiest on is the 'Moon Filter' which allows better observation of the Moon at periods near to full moon. Red, green and blue filters can be purchased and used for planetary or stellar use. Jupiter's cloud belts can sometimes be seen better using coloured filters. Eyepiece held solar filter should not be used!

Motor Drives

Motor drives are special motors which attach to the Equatorial Mount and allow the mount to be driven in Right Ascension. This motor 'counteracts' the Earth's rotation. The object you are viewing will remain (if the mount is correctly set up) within the field of view of the telescope, and no further adjustment would be necessary, with the exception of declination, unless you have a special declination motor drive. The drive is useful at any time and should be seriously considerd if doing astrophotography. It will allow fairly high magnification photographs to be taken through the telescope.

Poro Prism

A Poro Prism is a piece of optical equipment which 'inverts' the normal astronomical image to one that can be used terrestrially (i.e., looking at ships at sea, wildlife, etc). Again it is placed into the focusing mount of the telescope and an eyepiece placed in the other aperture and locked in using the screw. A good point here is that unlike spotting scopes, the magnification can be altered.

External Camera Mount

The External Camera Mount can be placed on top of the telescope brackets and then a normal camera with a “B” setting can be mounted upon it to use your camera to get pictures of the sky, or comets, if one is in view. The camera can be guided by using the slow motion drives, keeping a 'guide star' in view and trying to keep the star in the centre of the field of view. If you have an RA motor it is even better. Long exposures can be made of wide areas of the sky, and fainter object will be seen. Again the equatorial mount must be set up correctly.

SCS Astro Video Camera Systems

SCS Astro has a range of electronic video camera systems for use on telescopes.These are merely placed into the focusing mount and then connected to a computer or video recorder/TV. Then recording of astronomical events may be made. 'Snapshots' from video may be made via computer image capture cards and software. Get in touch with SCS Astro for details.

SCS Astro equipment catalogue can be viewed via the Internet on http;//www.scs.astro.co.uk

Collimating the Voyager 114

The purpose of collimation is to align the optical path of the telescope so that all the elements are in the correct position relative to each other, thereby ensuring the telescopes optimum performance.

To begin, remove any eyepieces and point the telescope to the open sky in daylight. Lock the declination axis. Insert the sighting eyepiece open end first into the focusser so that about 3-4 cm of the barrel protrudes from it.

Now, with your eye to the hole in the bottom of the sighting tube, you should be able to see the image of the main mirror reflected in that of the secondary with the dark silhouette of the secondary holder and its three supporting arms concentric with the main mirror. This is how it should appear: chances are that one or both of the mirrors will need some attention especially if you've been moving the telescope about a great deal.

With the sighting tube still in place, check first that the outline of the secondary mirror is concentric with the main mirror - in other words, is the circular outline of the main mirror's reflection wholly contained within the secondary's. If this is not the case, use a screwdriver to gently loosen the three collimating screws of the secondary mirror's holder - you may have to apply a little force to break the resin seal on each screw, but don't worry about that. By experiment, you will see that the central screw adjusts the whole assembly back and forth along the axis of the tube and that you can rotate the secondary mirror housing about this latter axis, too. With a little experimentation you will soon have the reflection of the primary concentric with that of the edge of the secondary mirror - now gently tighten each of the radial adjusting screws by the same amount to fix this aspect of the collimation. If you wish you can place a drop of adhesive back onto these screws.

Having done this, you may find that the silhouette of the secondary mirror and its supports are not in the centre of the primary mirror image - this is due to the main mirror being out of alignment.. Now, which of the three adjusting milled screw heads on the main mirror cell should you turn: while looking in the sighting tube, run your hand around the inside edge of the mouth of the tube until the reflection of your hand coincides with the side to which the image of the secondary mirror holder's silhouette falls; the milled screw to adjust is the one that lies at the bottom of the tube in line with your hand. Again, a little trial and error is called for here, but it's all good practice for the future!

The sighting tube is a very sensitive means of determining precise collimation, so don't worry if you cannot get everything exactly concentric - Newtonian's of f/7 or 8 focal ratio are fairly tolerant to minor errors of this sort.

ASTRONOMICAL RESOURCES

Astronomical Societies

Society for Popular Astronomy
36 Fairway, Keyworth, Nottingham. NG12 5DU (Good for beginners to start with)

British Astronomical Association
The Assistant Secretary, B.A.A, Burlington House, Piccadilly, London,
WIV 9AG. Tel: 0171 734 4145

Local astronomical societies may be found at your local lending library

Astronomical Magazines

Astronomy Now

A good British astronomy magazine, which can be obtained from any book or magazine shop, and carries a lot of information for the beginner to the advanced amateur.

Astronomy

This magazine, also available in good bookshops, is primarily for use in the United States. but the articles and other information given can be of great use to astronomers in the United Kingdom.

Sky and Telescope

Another popular USA magazine, available in bookshops.

Popular Astronomy

This magazine is the journal of the Society for Popular Astronomy, and may be found at bookshops at sites of astronomical interest. It is free to members of the Society.

Places of astronomical interest

The London Planetarium

This planetarium, near to Baker Street Underground Station, is next to Madame Tussards and is currently using the latest technology in planetarium computer projection systems.

Jodrell Bank Radio Telescope Visitor Centre

Off the M6 (junction 18) in Cheshire, this centre is the home of the (once) largest radio telescope in the world. There is a visitor centre, shop, rest area, cafe, arboretum and planetarium. Hands on experiments available.

Amargh Planetarium

In Northern Ireland, this is the best!. With displays and other hands on exhibits available. The planetarium uses computer technology and may have audience participation. A shop is available and most products sold there are available by mail order.

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