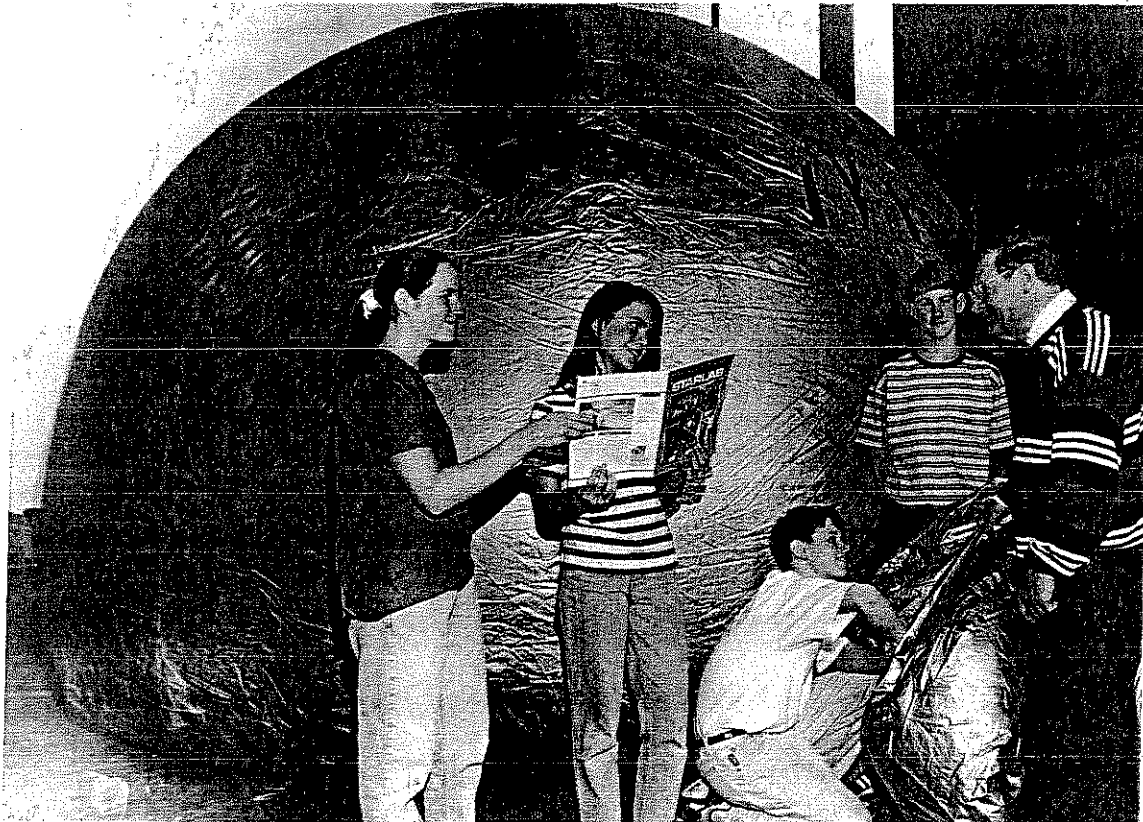


# Classic STARLAB®

Portable Planetarium System



— Part A —

Set-up, Operation and Maintenance

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Welcome aboard  
and keep the stars  
in your eyes!

## Getting Started

### Introduction

Thank you for your purchase of the STARLAB® Planetarium System. We welcome you to a growing family of educators who have come to appreciate the versatility and excitement inherent in the STARLAB® system. In this section, you will be provided with all of the information needed to successfully set up and operate the STARLAB Portable Planetarium System. In addition, we've included a number of maintenance tips, which will keep your STARLAB system in peak operating condition for years to come.

The staff of Science First/STARLAB® is not only committed to providing you with the finest equipment available, but with the highest quality service possible. We are always looking for ways to improve our products and service and we would love to hear from you. If you have specific questions, please contact us using the information below.

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## Safety Rules

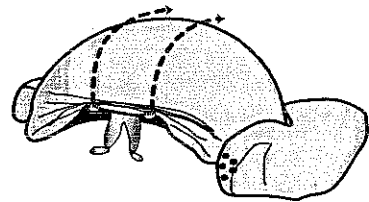
In order to maximize the overall quality of your STARLAB experience, and make certain that the system components are not damaged in any way, it's important that you always follow these simple safety rules when using the STARLAB System.

1. Never set up the STARLAB dome near an open flame or point heat source such as an incandescent light bulb or a radiant heater. These can easily damage the dome. Never allow anyone who is smoking in or near the dome.
2. Never allow food or drink inside the STARLAB dome as it could make the inside of the dome sticky or could cause damage to the projector and projection cylinders.
3. Never leave projection cylinders lying loose on the floor when they are not in use. These should always be stored in either the cylinder or projector case.
4. Never set up the STARLAB outdoors. It is not designed to be exposed to moisture and direct sunlight, and even a gentle breeze could move the dome when it is inflated.
5. Never allow a group of students to be alone in the STARLAB. The instructor should always be the first one in and the last one out. Upon leaving the STARLAB dome, the instructor should check to make sure that there is no one remaining in either the entrance or inflation tubes.
6. Always make sure that there is a clear path out of the STARLAB in the event of an emergency. Never set up the dome so that it is on the edge of a stage where individuals might fall off. Always show occupants that they can quickly exit underneath the dome wall in the event of an emergency (see below). Do not use the entrance tunnel to evacuate the dome in the event of an emergency.

## Emergency Procedures

The instructor should always have a working flashlight at hand in the event of a power failure in the STARLAB. If the lights go out, shine the flashlight straight up at the middle of the dome to illuminate the STARLAB. If the fan stops working, the STARLAB dome will not collapse quickly, but will slowly start to deflate. As a result, this will give you time to have someone make a quick check of the fan to make sure that it is plugged in and turned on. If the fan cannot be restarted, it will be necessary to evacuate the dome as quickly as possible. Instead of exiting via the entrance tunnel, have the visitors exit using the following emergency evacuation procedure:

- Have all visitors stand up and move toward the center of the dome. If you are using carpet squares, have each person pick up the one they are sitting on.
- Grasp the edge of the dome fabric directly opposite the side of the STARLAB where the inflation and entrance tubes are located. Lift the fabric up and over the visitors so the dome flips over onto itself. Once in motion, the fabric should continue to bunch up on itself so it falls to the floor between the two tunnels.
- In just seconds, the entire group can be evacuated.



## Planetarium Parts List

- 1 Projector
- 2 Projector/Cylinder Travel Case
- 3 Projection Cylinders
- 4 Dome Duffel Bag with Dome
- 5 Blower
- 6 Blower Travel Case
- 7 Slide Set of the Planets, Stars and Galaxies
- 8 LED Arrow Pointer
- 9 Accessory Box with replacement bulbs, planet set, moon set.
- 10 Tours of the Night Sky (tapes and CD)



### Packed Standard Dome

Dimensions: 36" x 18" diameter  
(91.4cm x 45.7cm)

Dome Weight: 45 lbs

Contents: Fabric Dome inflates to 16'  
dia. x 10.5' high (4.88m x 3.2m)

Seating Capacity: 25-35 people

### Packed Giant Dome

Dimensions: 46" x 23" diameter (1.2m  
x 58.4cm)

Dome Weight: 90 lbs

Contents: Fabric Dome inflates to 22'  
dia. x 13.5' high (6.71m x 4.11m)

Seating Capacity: 60+ people

### Projector Case

Dimensions: 31" x 26.5" x 17" (79cm x  
67cm x 43cm)

Weight: 40 lbs

Contents: Projector and 2 cylinders, box  
of accessories, manual

### Fan Case

Dimensions: 25" x 25" x 10" (63.5cm  
x 25.5cm)

Weight: 20.5 lbs

Contents: Fan

The STARLAB Planetarium System consists of an inflatable dome, (which comes in two sizes), a projector and a high volume fan that is used to inflate the dome. The Standard STARLAB Dome is 16 feet (4.8 m) in diameter and has a ceiling height of 10.5 feet (3.2 m). It can easily accommodate 25 adults or 35 elementary-age students. The Giant STARLAB Dome is 22 feet (6.7m) in diameter, has a ceiling height of 13.5 feet (4.1 m), and has a seating capacity of 56 students.

When the STARLAB is packed for transport, the basic system is contained within two hard cases and a large duffel bag. One person can carry each component and the entire system will fit into most medium sized cars. In fact, the STARLAB system is so compact that most airlines will accept it as regular baggage.

## Before Setting Up The STARLAB®

### Room Requirements for Using the STARLAB

The type of room that you select to set up the STARLAB Planetarium will depend on which of the two domes is being used. For the Standard (16-foot) Dome, a minimum ceiling height of 11 feet is needed with a cleared square floor space of 21 feet. The Standard Dome can fit into most classrooms that have had the desks and chairs removed or on the stage of an auditorium. For the Giant (22-foot) Dome, the minimum ceiling height is 14 feet and an open floor space of 27 x 27 feet is needed. As a result of these bigger dimensions, the Giant Dome is most often set up in a gymnasium, large multipurpose room, or cafeteria.

#### Note

Although many rooms are constructed with a 10-foot ceiling (slightly lower than the dome), it is still possible to set up STARLAB because of the dome's

air-supported structure. This will result in the top of the dome being flattened somewhat as it rests against the ceiling. As long as the STARLAB isn't flattened by more than about a foot, the images projected inside will appear correctly with little discernible distortion. If the dome must rest on a ceiling, just be careful that it does not come into contact with any sharp objects like sprinkler heads or light gratings that could damage it. In addition, the dome should not rest on or near hot light bulbs or radiant heaters which can damage the dome fabric. Though tempting, the STARLAB dome should never be set up outdoors. Moisture can damage the fan and projector and direct sunlight on the dome will make it deteriorate faster. In addition, when inflated, the STARLAB dome is quite buoyant so even a slight wind will cause it to shift position.

### Preparing the Floor Surface

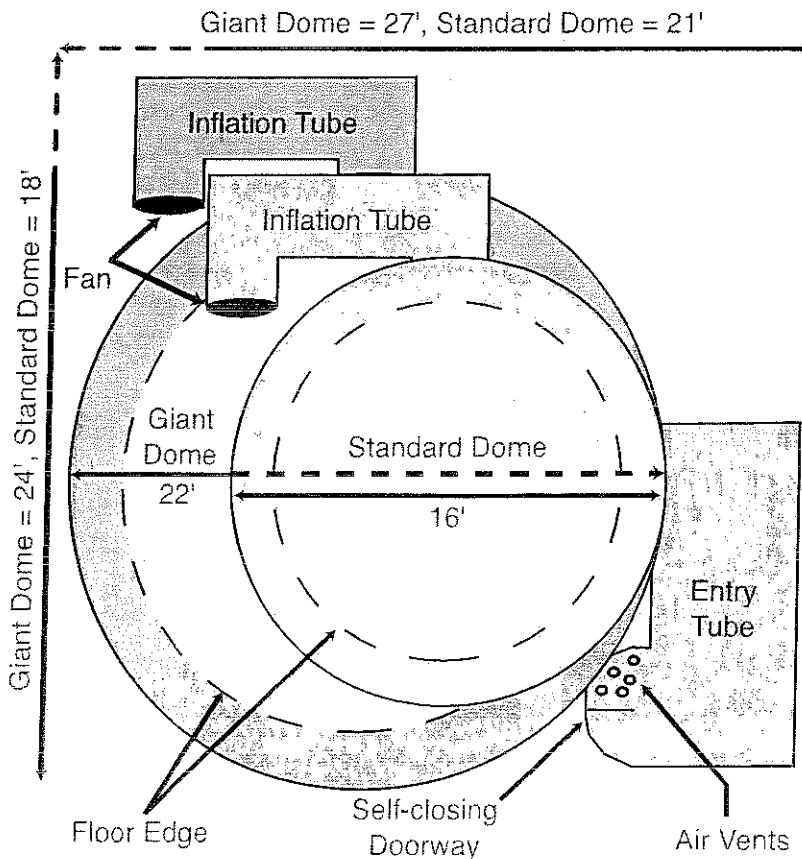
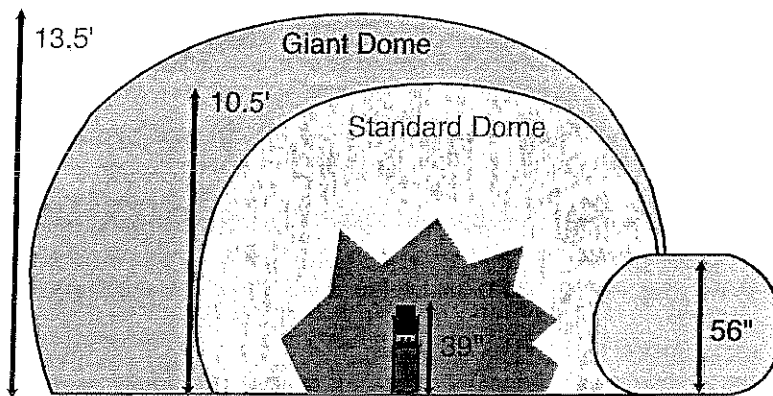
Because the STARLAB dome has no floor of its own, and participants sit on the floor, it is important to consider the floor surface. Ideally, the STARLAB should be set up on a carpeted floor. This provides maximum comfort for the participants, and reduces wear on the dome fabric. A wood or tile floor can also be used but these are hard and often are cold. When setting up on this type of floor, individuals can sit on carpet squares or pillows to make it more comfortable. It is strongly recommended that the floor of the room be thoroughly cleaned before the STARLAB is set up. Grit and dirt on the floor can cause damage to the dome when you are setting it up and taking it down. Another option is to place gym mats, a large canvas or piece of carpet to cover the floor beneath the dome.

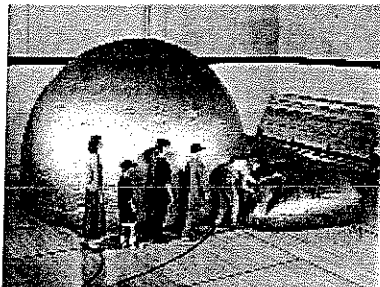
## Electrical Requirements for Using the STARLAB®

A reliable source of electricity is essential to keep both the projector and the fan running at all times when the STARLAB is in use. The fan is designed to plug directly into a regular 120 volt, 60 cycle grounded AC outlet. The voltage your projector can accept ranges from 100V to 250V AC, which covers most outlets. The STARLAB projector does not have any accessory power outlets so if you want to use any additional equipment such as slide projectors, tape recorders or reading lamps, it will be necessary to have a separate power strip inside the dome.

## Temperature

The STARLAB has no climate control of its own, so whatever the room temperature is on





the outside of the dome will be the temperature inside the dome. Because the fan keeps the air circulating continuously through the dome, it is usually several degrees cooler inside the STARLAB than out. Even so, in very hot climates, it is best to set up the STARLAB in an air-conditioned room. If possible, the STARLAB dome should not be set up under skylights or next to windows where direct sunlight can shine on the dome. This may cause the dome to heat up.

### Noise Level

While the STARLAB dome is completely light proof, sound can travel right through the material. As a result, the system should not be used in a noisy environment. People in the room outside the dome should be asked to remain quiet so they don't disrupt the program inside the STARLAB. Whenever possible, the STARLAB should be set up in a room that can be closed off from other classes so that they don't interfere with each other. Never attempt to set up the STARLAB at one end of a gym when classes are going on at the other end unless the two sections can be separated by a moveable solid wall.

### Set Up Time

While an experienced user can usually set up the STARLAB in less than 15 minutes, it is best to allow a full half-hour to unpack and put up the dome. Once it's connected to the fan, the Standard Dome will take about 5 minutes to inflate (about 10 minutes for the Giant Dome). Students who have never seen the STARLAB before are often excited to watch the set-up process. In general though, it is usually a good idea to set up the STARLAB before the class is brought into the room. Deflating the dome and repacking takes about 20 minutes total.

## Setting Up the STARLAB® Dome

### Before Unrolling the Dome

1. Check the electrical outlets that you are planning to use to make sure that they are "live" by plugging in and turning on the fan. Make sure you have adequate space to set up the dome and that you are not near the edge of a stage or blocking a fire exit.
2. Before setting up the dome, unpack the STARLAB projector and plug it in to make sure that it works properly. (See page A-11 for proper procedures). Once the projector has been checked, place it off to the side and proceed with setting up the dome.
3. Decide where you want the entrance and inflation tunnels to be located. Remember the two tunnels are at right angles to each other on the dome. In making your decision, try to envision the traffic pattern that will be created in the room once people start entering and exiting the dome. Make certain that the side of the dome opposite the two tunnels is not next to the edge of a stage or dead ending into a wall. This side must be kept clear in the event that you must lift it for an emergency evacuation.
4. Make certain that the floor where you are setting up the STARLAB is clean and free of grit that can cause holes when the dome is unrolled. If you are going to use a temporary floor covering such as a tarp, rug or gym mat, spread it out on the floor before unrolling the dome.

## Inflating the STARLAB® Dome

1. Unzip the canvas duffel bag and remove the dome. The dome should have two luggage straps securing it. Remove the straps and put them back into the bag so that they don't get lost. Zip the bag closed and place it in a safe location where you can find it easily when it's time to pack up the STARLAB.

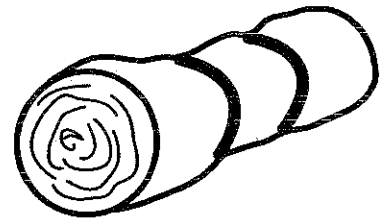
Note: The fan case is useful for storage once the fan has been removed.

2. Start unrolling the dome across the floor where you are planning to set it up. As you unroll it, spread out the material so that you can identify the entrance and inflation tubes. The inflation tube is the smaller of the two tunnels and has snaps around the opening. The entrance tunnel has the STARLAB logo printed on it.
3. Once the dome has been completely unrolled and spread out, turn it so that the two tunnels are in the positions that you have pre-selected. When moving the deflated dome, try to minimize the amount that it is dragged along the floor. Dragging the dome can cause small holes to develop in the fabric.
4. After the dome has been properly oriented, remove the fan from its carrying case and plug it in. The fan can either be plugged directly into the wall or into a heavy-duty extension cord. The fan has snaps around the metal protective cage that line up with the snaps on the opening of the inflation tube.

Note: Over the years, the fans have changed. If you have an older system, the exact procedure for attaching the fan to the tunnel may vary. In most cases, a specific diagram should be found in the fan box. The diagram on the next page shows the most recent fan design.

5. Begin connecting the fan by first attaching the bottom two snaps on the fabric. The bottom snaps are located about 2 feet apart, while all of the other snaps are about 9 inches from each other. After you've attached the bottom snaps, begin connecting the side snaps going up one snap at a time on each side. Finally, attach the single snap on the top of the fan.
6. After the fan has been secured to the dome, turn it on high. As the dome begins to inflate, walk around it lifting it slightly until it starts to take a circular shape. Make sure that the two tunnels are not twisted or folded and that the edge of the fabric inside the dome is completely flat against the floor. You can speed up the inflation process by holding the entrance tube closed so no air comes out. Once the dome is completely inflated, the entrance tube will close automatically. When the dome is fully inflated, it may begin lifting off the floor slightly.
7. Both the inflation and entrance tubes have two right-angled bends in them to prevent light from leaking into the dome. Walk around the outside of the dome and make sure both of these tunnels are "squared off". Also make sure that the back of the fan is set back at least 18 inches from the dome material.

Note: If the fan is too close, the fabric of the dome can block the airflow causing the fan to overheat and the dome to collapse. It is a good idea to place the empty fan box in between the inflation tunnel and the inflated dome to serve as a buffer in case the dome drifts while the program is taking place.

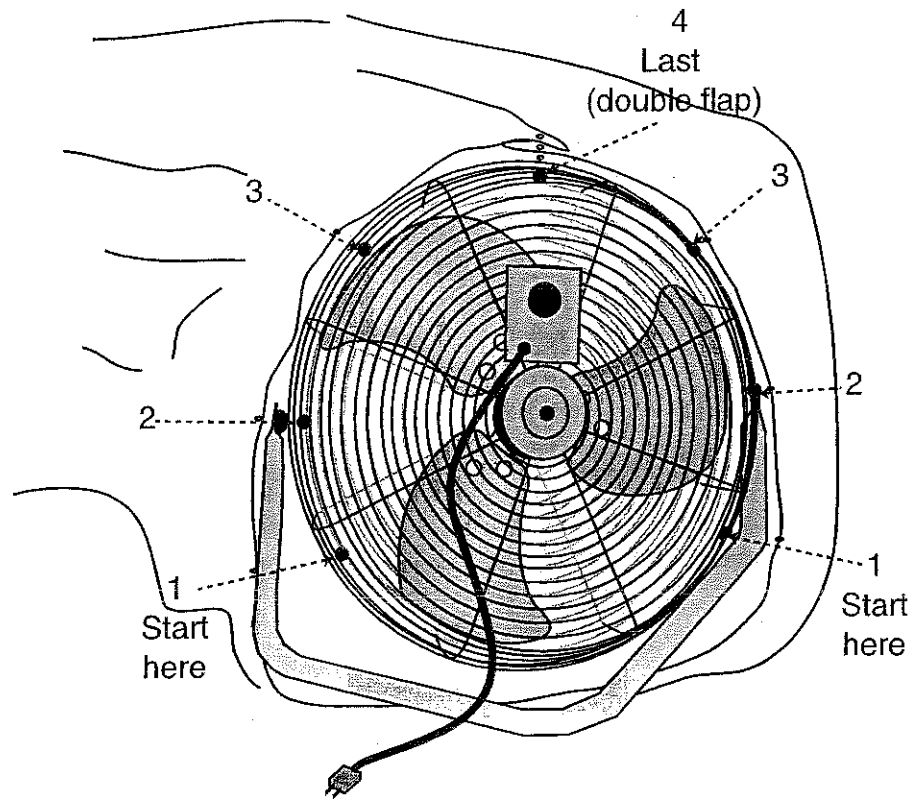


## STARLAB® LED Projector

### Introduction

The STARLAB LED Projector uses a modern means of projecting images. By replacing the standard halogen projection bulb with a powerful light emitting diode, the STARLAB provides an image clarity that is unsurpassed by any other portable planetarium projec-

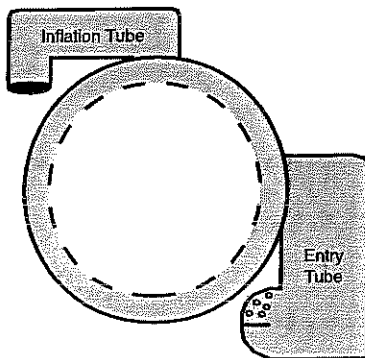




tor available today.

While the STARLAB LED uses the same projection cylinders and setting procedures as the STARLAB Standard Projector, it also offers a variety of new options not previously available. The LED includes separate meridian and cardinal points projectors that greatly expand the way that the planetarium can be used. In addition, a variable speed motor allows you to adjust the speed of Earth's rotation and a selector switch allows you to change the direction for either the northern or southern hemisphere. The projector also includes two "gooseneck" side lamps that can be controlled in tandem. By manipulating these side lamps into a variety of positions, you will be able to effectively provide reading light for yourself and participants without disrupting the night sky. They can be adjusted to simulate sunrise and sunset and various levels of light pollution. Also, they can be adjusted to illuminate the control panel.

Because the STARLAB LED Projector has many more controls than the STARLAB Standard Projector, it is important that users familiarize themselves with all of the different components and maintenance requirements.



Make sure that the entrance and inflation tubes are "squared off" to prevent light from entering the STARLAB dome.

## Unpacking and Setting Up the STARLAB LED Projector

The STARLAB LED Projector is packed in a STARLAB projector case with one or two projection cylinders. In systems shipped prior to January 2005, the projector case doubles as the stand for the projector when it is set up in the planetarium. In systems shipped after January 1, 2005, use the Blower Travel Case or Cylinder Travel case as the projector stand in the dome to achieve the appropriate height for the projector. See pages A-12 and A-13 for more details on this.

When the projector is first shipped from the factory, it is encased in plastic wrap and the power cord is not attached. After it has been initially set up, the plastic wrap can be

discarded and the power cord can stay attached to the projector. Remove the Velcro strap around the head of the projector.

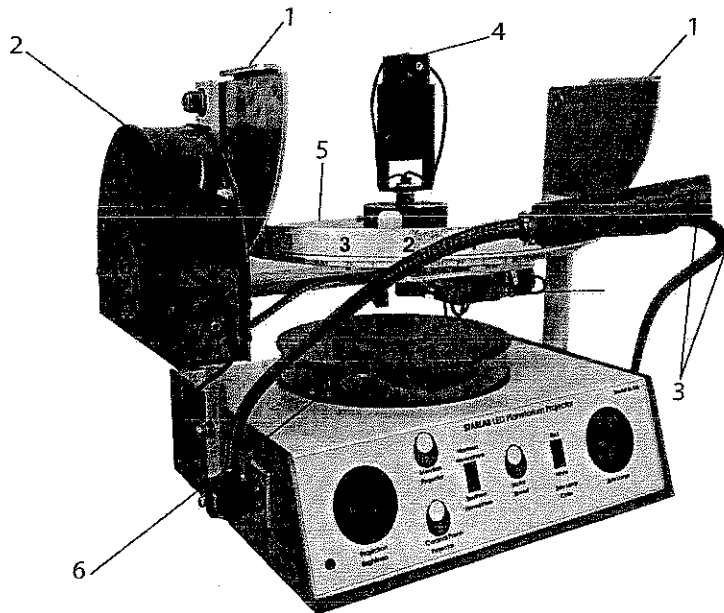
**Note:** When repacking for transit, wrap the power cord around the base of the projector under the clear plastic cylinder support plate. Fold the two gooseneck side lamps under the plastic plate and fasten the small Velcro strap around the head of the projector to keep it stable during transit.

Before setting up the projector in the planetarium dome, remove it from the case and check to make sure all of the components are operating properly.

Carefully lift the projector out of the box using the two heavy-duty aluminum bars located on either side of the projector. When carrying the projector, always hold it by these bars with two hands.

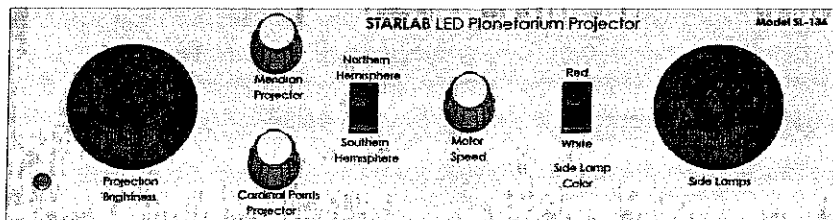
**Note:** Never attempt to lift or carry the projector by the gooseneck side lamps!

Place the projector on a table or similar stable work surface and carefully unwrap the power cord from around the base of the projector. Plug the projector into a working outlet and make sure that the other end of the power cord is securely plugged into the back



Parts Key:

1. 'U' Bar. Lift the projector by this.
2. Meridian Projector.
3. 'Gooseneck' side lamps.
4. Main Lamp.
5. Cylinder Plate
6. Cardinal Points Projector



Closeup of main control panel.

of the projector. The power cord supplied with the STARLAB is 8 feet long and should be plugged into a grounded extension cord or outlet.

Note: The power cord is not hard wired into the unit, but attaches to the projector by means of a three-prong plug. Unless this plug is in tight, the projector will not operate.

Carefully unfold the two gooseneck side lamps from under the transparent cylinder platform and direct them off to the sides of the projector. Once you have set up the projector inside the planetarium dome, you can adjust these lamps to give you appropriate room lighting.

Turn on the projector by pressing the on/off toggle switch located on the back of the projector. This switch also acts as a circuit breaker. When you turn on the switch, the red indicator light on the front of the projector should turn on. If the projector does not turn on, make sure that the power cord is securely plugged into the back of the projector and that the outlet you have the cord plugged into is live. A good way of testing the outlet is to plug in the STARLAB fan and turn it on. If the outlet is working and the cord is secure, then you should check the breaker on the projector to make sure that it is not tripped.

## Changing the Projection Cylinders

All of the projection cylinders used on the STARLAB planetarium are designed to work in the same way. They are made out of film and should be handled gently because they are easily crushed. Cylinders should be handled from the top and bottom rather than the sides. Before touching the cylinder, hands should be cleaned and free of hand lotion and perspiration.

Cylinders are held on the projector by four magnets attached to the clear plastic cylinder platform. At the bottom of each cylinder is a 2.5 inch diameter hole with a small notch cut into it. The hole allows the cylinder to be placed over the top of the projector and the notch lines up with the small white tab (cylinder alignment key) on the cylinder platform of the projector. When changing cylinders, the latitude adjustment bar must be set at 90 degrees in the polar position (straight up and down) and the clear plastic plate should be horizontal.

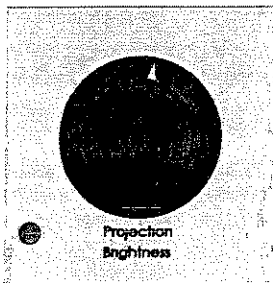
Warning: Changing cylinders when the support plate is tilted can cause severe damage to the projector!

Note the position of the cylinder alignment key on the cylinder platform and carefully slip the cylinder over the top of the projector until it rests on the clear plastic platform. Hold the platform with one hand so it does not rotate and slowly rotate the cylinder in either direction until the notch on the cylinder lines up with the cylinder alignment key.

Note: On most cylinders the notch is directly under the seam on the side of the cylinder.

When this happens, you will hear a "click" and the cylinder will lock into place. To remove the cylinder, first make sure that the projector is set for 90 degrees latitude (straight up and down). Grasp the cylinder at the sides directly under the top ring and gently pull straight up until the cylinder pulls free of the magnets. The magnets are quite strong so don't be surprised if it requires a little force to remove the cylinder.

Note: When cylinders are not in use, they should always be stored in either the projector case or one of the cylinder cases. Never leave a cylinder loose on the floor where it can get damaged!



## Controlling the Projector Brightness

Before turning on the projection lamp, you must make certain that the projector head is free to swing back and forth. When the projector is packed for shipping, a Velcro strap is wrapped around the projector head to keep it stable. Remove this strap by gently pulling it free and place it in a safe place (such as the accessory box) because you will need it for packing up the projector again.

After you have turned on the projector and removed the Velcro strap, you will be able to control the brightness by turning the knob labeled "Projection Brightness" in a clockwise direction.

## Side Lamp Control

The two gooseneck side lamps are controlled by means of a dimmer knob located at the extreme righthand side of the projector control panel (see photo on right). A toggle switch allows you to select which color you want the side lamps: white or red. White is better for general illumination. Red, especially at low intensities, does not damage your night vision. This makes it ideal for illuminating the controls or reading lesson materials while in the dome. To brighten the lamps, turn the dimmer in a clockwise direction and to dim, turn it in a counterclockwise direction.

In addition to being able to control the brightness of the side lamps, you can adjust the direction the light shines by bending the goosenecks. When moving the lamps, it is important to go slowly and make sure that you don't twist them, only bend them in one direction at a time. You can also adjust the direction of the side lamps by turning the plastic cowlings that cover the bulbs at the top of the gooseneck. While it is not recommended, it is important to note that the goosenecks that hold the side lamp bulbs can be removed from the projector body. Each gooseneck is attached with a four-pronged connector and the entire lamp assembly can come loose or even become disconnected if the gooseneck is twisted excessively.

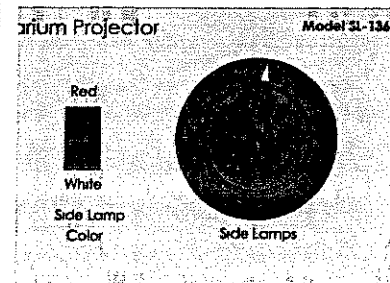
## Adjusting the Date and Time

You can set the STARLAB projector to view the sky for any hour of darkness for any day of the year. Along the front of the projector is a fixed hour bar showing viewing times from 7:00 PM to 5:00 AM. The 12:00 is midnight. Below the hour bar on the edge of the clear plastic cylinder platform are the months of the year.

Dates are approximated and can be set by turning the platform so that the relative day of the month is aligned under the selected viewing hour. For example, if you want to view the sky at 10:00 at night on November 1st, rotate the platform so that the tick mark between October and November is slightly to the left of the 10 on the hour bar. The projector is now set for 10:00 PM standard time for November 1<sup>st</sup>. Please note that in this position the projector is also set to show you the night sky at 9:00 PM on November 18<sup>th</sup> and 8:00 PM on December 4<sup>th</sup>. Remember you can view the same stars in the same position in the sky at different times for different days of the year.

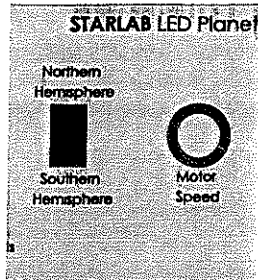
For daylight savings time, subtract one hour from the time you set the projector. For example, to view 10:00 PM on June 7<sup>th</sup>, rotate the plate so that the first half of June is directly under the 9 on the hour bar.

Note: When adjusting the time, always rotate the plastic cylinder platform plate directly. Turning the cylinder may cause damage.



## Adjusting the Latitude

You can set the STARLAB projector to view the sky from any location in the northern or southern hemisphere (from the pole to the equator) by tilting the projector support plate and using the Latitude Adjustment Bar found on the right-hand side of the projector. Look at the accompanying graphic. Below the latitude bar is a distorted map with latitude lines drawn every 15 degrees. When the projector is straight up and down, you are at the pole. When it's tilted all the way over to one side, you are at the equator. Decide what latitude you wish to view the sky from and calculate where it would be on the map using the marked latitude lines as a guide. If need be, estimate the position by interpolating between the marked lines. Tilt the entire projector platform until the desired location lines up with the edge of the bar marked "align location with this edge." The cylinder stays tilted due to torque nuts and will stay in this position until you change it.



Note: When tilting the cylinder, always use the two metal brackets on the two sides of the projector and never push directly on the cylinder because it may damage it. When changing cylinders, always reset the projector to the polar position.

## Earth Rotation Control

The STARLAB Projector has a variable speed motor and a selector switch to control the direction of Earth's rotation to match that of either the northern or southern hemisphere. The platform rotation switch is a toggle near the center of the projector control panel. Flipping the switch up to the "Northern Hemisphere" position causes the cylinder to rotate in a clockwise direction. Flipping the switch down to the "Southern Hemisphere" position causes the cylinder to rotate in a counterclockwise direction.

The speed of the rotation is controlled by the knob labeled "Motor Speed" located directly to the right of the direction control switch. Turning the dial clockwise increases the speed and counterclockwise decreases the speed. When the knob is completely counterclockwise (off), you can also move the projection cylinder manually by rotating the bottom of the clear plastic cylinder support plate.

Note: Rotating the projector at maximum speed may cause some individuals to experience motion sickness.

## Using the Cardinal Points and Meridian Projectors

The STARLAB Projector has two accessory projectors built into it to allow you to add specific reference points to the projections on the dome. The two small knobs on the right-hand side of the control panel independently control each projector.

The Cardinal Points Projector is built into the base of the LED Projector directly below the clear plastic projection cylinder platform. When it is on, it projects letters showing the 8 cardinal directions (N, S, E, W, NE, NW, SE and SW) along the horizon. The brightness of these letters is controlled by the dimmer knob labeled "Cardinal Points Projector". Turning the knob in a clockwise direction increases the brightness while a counterclockwise direction dims it down to off.

In addition, the cardinal points projector can swivel. This allows you to line up the North projection with actual North, if so desired.

The Meridian Projector is attached to the support bracket found along the lefthand side of the Projector. When it is on, it projects a scale (at 5 degree increments) across the top of the planetarium dome showing the angular measurement from the northern horizon to the zenith and across to the southern horizon. It is very useful for measuring star angles in celestial navigation and for calculating the position of the sun along the ecliptic during different months of the year.



## Maintaining the STARLAB Projector

The STARLAB LED projector uses Light Emitting Diodes for the main lamp, meridian projector, cardinal points projector, and side lamps. In addition to high intensity, these lights are extremely long lasting. You can expect each to last for thousands of hours. On the rare occasion that one of your lamps burns out, please contact us for a replacement.

The switch on the LED Projector also acts as a circuit breaker. If the breaker trips, simply move the switch to the off position to reset it. If the breaker continues to trip, contact us for instructions.

In general, keep the projector free of dust and moisture.

## Projecting the Sun and Moon

### The Sun

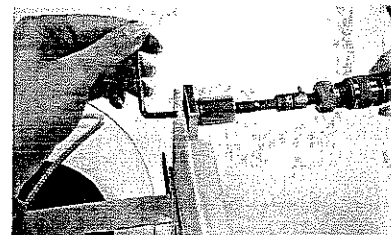
The Starfield Cylinder is unique because, unlike most of the cylinders, it has twelve magnetic light blocks around its circumference. These light blocks mark the position of the Sun along the ecliptic and when one is removed, it shows where the Sun would appear in the sky for each month of the year. Each light block is located directly above the name of a particular month listed on the cylinder platform on the projector. The position of the Sun has been set for approximately mid-month with the exception of March, June, September and December. On these months it has been offset to show the Sun on the 22<sup>nd</sup> of the month. This allows you to show the position of the Sun in the daytime sky for the equinox and solstice dates. To remove a light block, simply pull it out and place it on the magnetic strip located along the top front of the projector. This will keep the light block from getting lost. Set the projector for the desired latitude and turn the cylinder so that the "Sun" is seen on the eastern horizon. This is sunrise. By turning on the daily motion switch, you will see the Sun slowly move across the sky until it finally sets. This allows you to observe the elevation of the Sun, location of sunrise and sunset and the relative amount of time it takes to cross the sky for each month of the year making it easy to demonstrate the reason for the seasons.

### The Moon

While most people realize that the moon goes through a phase cycle, many don't understand that there is a clear-cut relationship between the phase of the moon and what time of day it's visible in the night sky. The reason we see the moon is because it's reflecting sunlight back to us on Earth. While half the moon is always being lit by the Sun, we don't always see the lit side. The chart at the top of the following page shows the relationship between the moon phases and the time of the day that they can be seen.

Because the moon is normally found to travel close to the ecliptic, and since it has the same apparent diameter as the Sun in the sky, the same light ports used to project the Sun can be used to project the moon in the sky. In order to show the phases of the moon, two identical sets of 5 magnetic moon phase inserts have been included in the STARLAB accessory box.

One set of inserts can be used to show the waxing phases while the second set can be used to show the waning phases. Each set includes a slim crescent, a wide crescent, a



quarter, a narrow gibbous and a wide gibbous. A full moon is projected by removing the light block and leaving the light port completely open. For a new moon, leave the light port blocked. Use the following procedure for setting a specific moon phase.

### Background

There are 29.5 days in one lunation, or complete set of moon phases. If the moon is full on the 15th of a particular month, then it will be full about the 14th or 15th of the following month. Because our months have lengths from 28 days (February) to 31 days, the phase repetition does not occur on the same day each month. In calendars that are true lunar calendars, like the Jewish, Chinese, or Muslim calendars, the phases repeat exactly each month, so the 1st of each month will be a new moon.

### Procedure

1. Determine how old the moon is. The age of the moon can be determined by looking at a calendar showing moon phases, by checking the newspaper for this information, consulting a source like the Abrams Sky Calendar, or referring to an internet site such as [www.skypub.com](http://www.skypub.com) for information about the current sky. Determine when the previous new moon was.

#### Examples:

- A. If the new moon occurred on the 4th of May, and today is the 9th of May, then the moon must be 5 days old.
  - B. If the new moon occurred on the 20th of November, and today is the 5th of December, then the moon is 15 days old (10 days left in November, and 5 days for December).
2. Consult the chart and select the correct moon insert. Follow the directions on the chart in placing the insert in placing the insert in the correct hole on the cylinder.
    - A. If you are showing the moon for May, and determine that the moon is 5 days old for the date you have chosen, select insert #2 (First Waxing Crescent) and after removing the light block from the hole positioned 2 holes to the right of the May Sun's position, place insert #2 in that hole. Be sure to turn the insert so that the visible portion of the moon is facing toward the Sun hole for May.
    - B. If you are showing the moon for December, and determine that the moon is full (about 15 days old) for the date you have chosen, simply remove the block from the hole positioned 6 holes to the right or left of the Sun. It is directly opposite the Sun's position hole, on the other side of the cylinder.

## Projecting Planets with the Starfield Cylinder

In addition to the magnetic moon phase inserts, the STARLAB accessory box also contains 5 clearly marked planet projectors that allow you to place any or all of the naked eye planets into the night sky. The planet projectors have the same type of magnetic attachment system as the moon phases and they use the same light ports on the STARLAB cylinder. Each planet projector is designed with a moveable mirror that allows the image to be accurately placed in the sky. In addition, each planet projector has its own filter and aperture so that the projections have a realistic color and magnitude. Using the planet projectors, you are able to project up to 5 planets in the night sky at the same time.

Start by identifying which planets you wish to project by looking at a detailed star map for the month you wish to view the sky. Star maps showing planetary positions can be found at many different Web sites as well as publications such as *Astronomy*, *Sky and Telescope* and *Science and Children*. You can also subscribe to monthly star maps and the sky calendar from the Abrams Planetarium in East Lansing Michigan. The star map will give you the exact location of the visible planets relative to the constellations and the

ecliptic.

Set the Starfield cylinder for the correct date and time and then locate the position in the sky where the planet should be. Find the light block closest to that position and remove it. If this light port is being used to project either the Sun or the moon, remove the light block from the next light port over to either the right or left. Place the magnetic bottom of the planet projector over the hole so that it "locks" into place.

Make sure that the planet projector is centered over the hole in the cylinder. If the light does not shine directly through the hole, the brightness of the planet will be diminished or it will not be visible at all. Gently move the handle on the planet projector back and forth while looking toward the sky. You should see a bright "star" moving back and forth. This is the planet you are projecting. By rotating the planet projector in the hole and by moving the handle that controls the mirror, you can move the planet into the desired location. If you are setting more than one planet, you can move onto the next one and the first planet will remain set in its position, even when the Starfield cylinder is put into motion.

#### Note

Be careful not to force the handle of the planet projector beyond the stopping point or you can damage the mirror. When the planet projectors are attached to the Starfield cylinder, the cylinder will not fit in the round cylinder storage bin in the projector case. If you want to remove the cylinder and use it again without resetting the planet projectors, you can store the cylinder temporarily in the large rectangular bin in the projector case. Never clean the mirror on the planet projector with any abrasive cleaner or material. They are easily scratched!



## Taking Down and Packing Up The STARLAB

After you have completed your STARLAB presentations for the day, it's time to break down and repack the STARLAB back into its cases.

If you are going to use the STARLAB for several days and it's in a secure room, it is not necessary to completely pack it up each night. Simply place the projector on the floor next to the stand, leave the side lights on and exit the dome. Pull out the power cords and turn off the fan. The STARLAB will deflate and the fabric will rest on the stand making a "tent" over the projector. When you turn the fan on again, the STARLAB dome will inflate and then you can plug in the projector and place it back on the stand, picking up where you left off the day before. Make sure the projection cylinder is removed before deflating the dome!

Start by removing all planet projectors and moon phases from the Starfield cylinder and putting them back into their proper places in the accessory box. Make sure that you replace the steel light blocks in all the light ports, take the Starfield cylinder off the projector and slide it back in one of the round storage compartments in the projector case. Turn off the projector and place it on the floor next to the projector stand. Exit the dome and turn off the fan. The STARLAB dome will begin to deflate. After it has dropped about 3 feet, go to the side of the dome opposite the two tunnels and lift the material about 5 feet off the ground flipping it back toward the opposite side of the dome. If you do this quickly, the dome will ride back on the air that was trapped inside forming a crescent shaped pile of fabric on the floor as shown in drawing at right. Allow the dome to sit for a few minutes so that the remaining air gets out of it and continue packing up the projec-



tor and fan.

Unplug the fan from the power outlet and unplug the inflation tube. Wrap the power cord of the fan around the two metal brackets on the back of the fan and place the fan inside its box, snapping the lid shut. Place the fan case off to the side so that it is out of the way.

Unplug the projector from its power outlet and unplug the power to the motor that controls the daily motion from the back of the projector. Make sure that the latitude adjustment for the projector is set at 90 degrees (polar position, straight up and down) and carefully wrap the power cord for the projector around the base of the projector directly underneath the clear plastic cylinder platform. Put the protective packing material back on the top of the projector. Lay the projector case/stand so that it is flat on its back on the floor and place the projector inside the large rectangular compartment.

**Note:** Always carry the projector by the two heavy metal bars on either side. Place the accessory box in the smaller rectangular compartment of the projector case along with any flashlights, extra pointers or other accessories that you are using with your STARLAB. Make certain that the pointers are turned off before storing them in the accessory box!

Place the lid on the projector case by inserting the two hinges in their tabs.

**Note:** Make certain that you are using the correct lid! The lid for the cylinder cases is the same size as the projector case lid. The cylinder case lids DO NOT have cut outs for the projector and if they are forced on the projector case, they can cause serious damage to the projector!

Once the lid has been placed on the case, snap it closed and move it off to the side next to the fan case.

### Rolling and Packing the STARLAB Dome

While the STARLAB dome can be rolled in many different ways, the following procedure is the recommended method.

1. Once the dome has been flipped over and deflated, it should look like a large crescent shape on the floor with the two tunnels sticking out.
2. Fold the inflation tube over so it lays flat on the rest of the dome material. Fold the entrance tunnel in half lengthwise over on itself, and then fold it a second time so that it is now lying flat on the dome fabric. The dome material should now have a near perfect crescent shape.
3. Walk along the length of the crescent pushing the edges in so that the width of the material is about 3 feet (one meter). Do not make it too narrow or wide because it will not fit back in to the dome bag. Start rolling up the dome like a sleeping bag from the inflation tube end. Remember, the tighter you start to roll, the easier it will fit into the bag! Pause every few rolls to let any trapped air come out. Kneeling or sitting on the dome will help to push the air out.
4. Once the dome has been completely rolled up, secure it with the two luggage straps. Unzip the dome bag and drape it over the top of the rolled up dome. Roll the dome over so the bag is now underneath and carefully zip the bag closed making sure NOT to catch any of the material in the zippers! Store the dome in a cool dry place. Do not store it in an unventilated closet or room that is damp because the canvas bag will get moldy.

## Routine Maintenance of the STARLAB

While the STARLAB planetarium system is designed to stand up to repeated use, it does occasionally need some routine maintenance to keep it operating in top form. Here are basic maintenance procedures that should be done periodically.

### Dome

The dome is made from a nylon/vinyl (no latex) composite fabric and is bonded together with specially-formulated adhesive. While the fabric is quite durable and does not tear easily, it can get small punctures that allow light to shine through from outside creating extra "stars" in the sky. These holes can be patched using peel-off adhesive backed dome patches found in the accessory box. To patch the dome, inflate it in a brightly lit room and enter with a flashlight. Turn off all the lights inside the dome and wait for any "stars" to shine through. Since the projector is not on, these "stars" are holes. Peel and stick the patches onto the dome from the inside so they completely cover the hole. If holes are too high to reach, simply turn off the fan and allow the dome to deflate until you can reach the holes. Do not use duct tape to patch holes.

If the dome gets dirty, it can be wiped clean with a sponge while inflated with warm soapy water. Never use cleaning fluids or solvents!

Note: Never stand on a ladder or chair to patch holes. In the dark it's easy to become disoriented and fall.

### Projector

Before cleaning the projector, make certain that it is unplugged from the electrical outlet. Both the projector case and the clear plastic cylinder support platform can be cleaned with glass cleaner and a soft cloth or paper towel. After repeated use, the latitude adjustment bar may begin to sag. It can be easily tightened by using a  $\frac{1}{32}$  inch hex wrench and a  $\frac{1}{2}$  inch wrench over the nut that holds it to the metal support bars attached to the side of the projector. Be careful not to overly tighten the nuts because you won't be able to adjust the latitude!

### Projection Cylinders

Projection cylinders are made from film and, while they are made to last, they need to be handled with care. Any dents to the cylinder should be removed as soon as possible. Dents can usually be popped out by applying light pressure on the outside of the cylinder around the dent. Never put anything inside the cylinder because it can scratch the images. Normal fingerprints on the outside of the cylinder will eventually degrade the projections. It is not recommended that you try to clean the cylinders. They should be packed up and sent back for periodic cleaning. In an emergency, cylinders can be cleaned with distilled water and a soft LINT FREE cloth. NEVER use any type of soap, solvent or window cleaner on the cylinder! When the outside of the cylinder is damp, it is extremely tacky and lint, dust and dirt can easily stick to it, permanently damaging the cylinder. NEVER get water or any other liquid inside the cylinder as it will destroy the images!

### Fan/Blower

After several months of use, dust and dirt will build up on the fan blades and motor. This can easily be removed by vacuuming the motor with a soft brush attachment. The nuts on the support bracket of the fan should be tightened periodically with a wrench to keep them from rattling.

## Troubleshooting

What happens if the projector does not go on even when I know the power outlet works?

There is a breaker on the back of the projector that may trip if a power surge occurs. Move the power switch to the off position to reset the breaker. If the breaker continues to trip, contact us for support.

What happens if I turn on the daily motion switch and the cylinder doesn't rotate?

A motor is mounted under the cylinder plate to drive daily motion. Check and see if the belt that drives the cylinder at the base of the projector is tight. It may have become stretched or it may have broken. In either case, a replacement belt can be ordered from Science First/STARLAB. After many years of use, it is possible that the motor may burn out. A replacement motor can be ordered from Science First/STARLAB.

What happens if I'm missing some light blocks for the Starfield cylinder?

Spare light blocks are included in the accessory box and new light blocks can be ordered from Science First/STARLAB. DO NOT USE adhesive backed dome patches or tape to cover the light ports on the Starfield Cylinder!

What happens if I see "stars" shining through the dome even when the projector is turned off?

The extra stars are really tiny holes in the dome. They can be easily patched by using the pre-adhesive peel-and-stick dome patches included in the accessory box. Extra dome patches can be ordered from Science First/STARLAB. See the section on dome maintenance (page A-18) to learn the proper procedure for patching the dome.

## STARLAB User Tips

### Entering and Exiting the STARLAB

Because the STARLAB dome is an air-supported structure, leaving the door open for an extended period of time will cause the dome to begin to deflate. As a result, it's necessary to have visitors enter the dome in a controlled fashion. Visitors should be instructed to enter and exit the dome in a single file line, one at a time. While they do not have to crawl, they should be instructed to "stay low and go slow". It is always a good idea to have two adults working to assist when students are going in and out of the dome. One adult acts as the "door keeper" on the outside while the second stands inside the STARLAB where the entrance tunnel meets the dome. After every three people enter the dome, the "door keeper" should hold the entrance tube closed for about 5 seconds to give the dome a chance to re-inflate. It is also helpful for the person on the inside to have a flashlight or battery powered lantern that he or she can shine in the tunnel to help illuminate the way. Have the last person entering the dome turn the fan down to medium or low.

Once inside the dome, visitors should be instructed to sit on the floor on the edge of the fabric in a circle. They should not lean back on the dome fabric because it might cause

the dome to be pulled down or rock excessively. Nobody should sit in the space directly in front of the fan opening nor should anyone enter the inflation tube. If there are more people than a single circle can accommodate, then visitors can make a second inner circle surrounding the projector. Because the STARLAB does not have any seats, one suggestion is to lay out carpet squares on the floor before the visitors come into the dome. In addition to providing some comfort, the carpets help to define specific seats, which is particularly helpful for younger visitors.

When it is time to exit the dome, the "door keeper" should leave first and hold the dome entrance open for the group to exit. Visitors should exit single file being careful not to trip over the fabric at the end of the entrance tunnel when they leave. When people are exiting the dome, the fan should be on "high."

## Accommodating Visitors Who are Physically Challenged

Because of its unique design, the STARLAB can accommodate visitors who are restricted to wheelchairs, have walkers or are otherwise physically challenged. Instead of having these individuals use the entrance tunnel, they can enter and exit the planetarium by going in and out under the edge of the dome. To do this, you will need a second person to assist you. Individuals who are physically challenged should be brought into the dome before the rest of the visitors. Begin by turning up the fan to the highest setting so that the STARLAB dome becomes overinflated and starts lifting off the floor. Remove all carpet squares from the inside of the dome and maneuver the individual to the side of the planetarium directly opposite the point where the entrance and inflation tubes attach to the dome. With the help of a second person, lift the side of the STARLAB and roll the person in the wheelchair under the material toward the center of the dome, next to the projector. Drop the side of the dome back down behind the person and allow the dome to re-inflate. Once the dome has fully re-inflated, have the rest of the participants enter the dome through the entrance tunnel making sure to keep the entrance tunnel clear. Have the last person entering the STARLAB turn the fan back down to low. Once the entire group has been seated, back the wheelchair into the opening to the entrance tunnel. This way, they will be able to see everything without blocking the view of other visitors. When the program is over, move the wheel chair out of the tunnel and position it next to the projector. Allow the rest of the group to leave via the entrance tunnel and then remove the person in the wheelchair the same way that you brought them in.

## Seating Inside the STARLAB Dome

Placing carpet squares on the floor to establish a seating pattern helps to make things more orderly for classes entering the STARLAB. Not only do these pads help to define each student's space, but also they make sitting on a cold, hard floor a bit more comfortable. Carpet squares can usually be obtained from large carpet stores who use them as samples. Quite often, they will donate old samples to schools and other educational establishments. When they do charge for them, they usually cost only a few dollars each.

## Accessory Lighting Inside the STARLAB Dome

There are many occasions where you might want additional lighting in the planetarium. In order to perform activities like reading star maps and completing worksheets, it is very helpful to use an auxiliary light source. One system that works well for the STARLAB planetarium involves using one or more clamp-on photo lights plugged into tabletop or hand-held dimmers. Both the lamps and the dimmers are available at most hardware and home improvement stores. The clamp-on lamps should have reflectors to direct the light downwards to provide light for reading and writing. This allows images to still be seen on the dome while the lights are on. A second light can be positioned with the reflector pointing upward for general room lighting and for simulating the Sun. These additional

Lights also make it easier for visitors to see in the entrance tunnel when they enter and exit the dome. The auxiliary lights can be clamped directly to the top of the projector stand or to a board placed under the projector that hangs over the side of the stand. Using the dimmer allows you to adjust the light to the proper level for each activity and it's best to use 40-watt bulbs.

You can vary the arrangement of clamp-on lamps and the color of the light bulbs to suit the needs of the particular lesson that you are conducting. With a blue bulb and the reflector pointing upward, you can simulate a daytime sky. To make it easier for your students to read while they are in the dome, you can use a red bulb with the reflector pointing down.

A six-volt camping lamp or lantern is a perfect addition to help provide extra lighting in the tunnel when people enter and exit the dome. By placing it on the floor at the inner end of the tunnel, people can be directed to "walk toward the light" without tripping over the material or wires. Adding an opaque top cover on these types of lamps turns them into an excellent reading lamp for you to use as well.

Many experienced planetarium users have experimented with far more complex lighting systems that usually involve hanging small lights from the dome itself. Some variations of this include using Christmas tree lights, tube lighting (as found along aisles in movie theaters), or 5-watt bulbs in lightweight, clip on sockets with small metal reflectors. Extension cords plugged into a tabletop or hand-held dimmer, can be extended out to the light positions and taped to the floor to prevent people from tripping over them.

Lights can be attached to the dome either by Velcro or by flaps made from strips of duct tape. The duct tape is folded over so that most of the tape sticks to the dome wall, but leaving a 2 to 3 inch long flap hanging down. Two more strips of duct tape placed horizontally over the first piece adds more strength to the attachment. An optimal height for securing the flaps is about 1.3 meter (4 feet) above the floor.

## Marking Positions On the Dome

For many activities, it is useful to mark positions as reference points inside the planetarium. You may wish to mark the path of the Sun across the sky so that you can compare the angle of insolation on a winter and summer day. You may also want to have students predict and mark the position of the sunrise and sunset points for different days of the year or mark the position of different constellations as they appear to move across the sky. In the STARLAB, it is possible to mark all of these things using Post-it style notes or index cards backed with double stick masking tape. Students can write their names right on the labels and attach them directly to the inside of the dome. Using this same technique, you can also label the cardinal directions using cards that have the letters written in dayglow or phosphorescent paint.

## Pointers

For some activities, you may wish to have more than one pointer available for use. You can divide the group into teams for example, with each team being given a pointer. To help differentiate between the different pointers, you can use pointers with different images such as a lightning bolt, a finger or several different shaped arrows. Science First/STARLAB also manufactures a heavy duty LED pointer that comes in several different designs. (Part #SL-541) These LED pointers are better for student use than laser pointers because they are far more durable, have a longer battery life, and most importantly, they pose no risk to eyes even if they are shined directly into a person's face.

## Dome Management

Over the course of a day, the dome has a tendency to shift its position on the floor. This usually does not cause a problem but it could make the projector drift off center after a while. In order to minimize the amount of distortion in the projections, it is important that the projector be directly under the center of the dome. Each time a group exits the STARLAB, it's a good idea to go back outside and realign the dome to its original position. The amount of dome shift can be reduced by making sure that there are no kinks, deep wrinkles, or bends in the inflation tube. Placing carpet squares along the inside edge of the dome will help to weigh the dome down which also reduces drift.

Note: Under no circumstances should you ever tape the bottom of the dome to the floor. This will make it difficult to lift the dome in the event that an emergency evacuation is needed!

## Creature Comforts

A whole day of teaching in the STARLAB can be grueling. Little amenities can help a great deal. For example, if you like to operate the projector from your knees, a set of gardeners' knee pads help a lot. A short stool (camping stool) or kindergarten chair can also be used if you prefer to sit up and, if you like to sit on the floor, a stadium chair that is really a cushion with a back support works wonders. When all else fails, you can always use a pillow. Having throat drops and a sport bottle filled with water also helps preserve the throat. Take frequent drinks and don't forget to stretch!

Enjoy using your system!