A Teacher's Guide to

THE STARGAZER

Presented by the
Cernan Earth and Space Center
Triton College
River Grove, Illinois

Welcome to the
Cernan Earth and Space Center

Introduction

Please take a few minutes to read through this Teacher's Guide before you and your group visit the Cernan Earth and Space Center. It contains important tips and guidelines about your field trip, describes the program that you selected and includes some teacher resources to help you better integrate your Cernan Center visit with your own classroom activities.

The Cernan Earth and Space Center

The Cernan Earth and Space Center of Triton College is a unique and exciting place for persons of all ages. The Cernan Center houses a 100-seat dome theater, a Space Hall with exhibits on space exploration and astronomy and the Star Store gift shop.

The Cernan Earth and Space Center is named for astronaut Eugene A. Cernan, who flew aboard the Gemini 9, Apollo 10 and Apollo 17 space missions. In December of 1972, as the commander of Apollo 17, Captain Cernan became the last human to leave his footprints on the moon. Cernan was born and raised in suburban Bellwood, not far from where the Triton College campus and the Cernan Center now stand. The original Cernan Center building opened in 1974, and in 1984, it re-opened in a new and larger facility.

The Cernan Earth and Space Center's 44-foot diameter dome theater is equipped with a planetarium star projector, a special C-360 motion picture projector, a sophisticated laser projection system, a large format video projection system, a powerful stereo sound system and scores of slide and special effects projectors. Using this equipment, the Cernan Center presents a wide range of educational programs that discuss such diverse subjects as the current night sky, the planets of our solar system, the weather and climate of earth, the space shuttle and the age of dinosaurs. For pure entertainment, the Cernan Center also presents laser light shows that choreograph laser images and planetarium effects to rock music.

The Cernan Earth and Space Center's Space Hall contains a variety of exhibits related to astronomy, space science and earth science. Included are Captain Cernan's Apollo 10 spacesuit and coverall garment, Apollo 17 moon gloves, an Apollo lunar landing diorama, a moon phase exhibit, a weather radar station, a 1/15th scale space shuttle model, a life-size dinosaur footprint model, an Illinois fossil exhibit, a telescope exhibit, an exhibit on recent space discoveries and a variety of other Apollo artifacts. Outdoor exhibits include an Apollo practice capsule and a Nike Tomahawk missile.

The Cernan Earth and Space Center's Star Store gift shop offers an assortment of unique gifts, many related to the popular themes of astronomy, space exploration and the study of our own planet earth. Books, t-shirts, sweatshirts, binoculars, science discovery kits, coffee mugs, posters and unique toys are just a few of the many items for sale. Some items are even $1.00 or less, so even younger patrons can buy a souvenir or two during their visit.

Important Field Trip Information

Listed below are a few tips to help make your trip to the Cernan Earth and Space Center run smoothly and stay on schedule:

1. BEFORE YOU ARRIVE. If for any reason you need to reschedule or cancel your reservation, please call the Cernan Center and let us know as soon as possible. Doing so allows us to better accommodate other groups that may prefer your original time slot and may prevent your group from being charged a cancellation fee.

2. ARRIVAL. Plan to arrive at the Cernan Center at least 15 minutes before your scheduled show. This will give you time to check in your group, use the restrooms if necessary and instruct your group to line up at the entrance to the dome theater. If you are planning to eat lunch or visit the Star Store before your show, you should arrive even earlier. Buses and vans should park along the curb directly in front of the Cernan Center and should remain there for the duration of your visit. Automobiles should park in the North Parking Lot just north of the Cernan Center building after dropping off their passengers.

3. CHECKING IN. When you arrive at the Cernan Center, the group leader should check in at the Star Store. Remember to bring the confirmation card that you received in the mail. Please make a note of the number of students and chaperons that you will be paying for. Remember that you must pay in bulk, so please collect the students' money beforehand or have a check made payable to Triton College. In special circumstances, you can make arrangements in advance to have us bill your school or institution after your visit.

4. ENTERING THE THEATER. Your group should be lined up at the dome theater entrance five minutes before your scheduled show time. Please remind your group that they are on a college campus and must remain quiet because of classes in session nearby.

5. SEATING IN THE THEATER. A Cernan Center staff member will let your group into the theater and instruct you on the best place to sit. Since more than one group is often scheduled at the same time, your group should sit together. No food, drink, candy or gum is allowed in the theater.

6. BEHAVIOR IN THE THEATER. Teachers and chaperons are responsible for the behavior of their group. Since the show operator is seated at the top of the room, he or she is often unable to hear or see minor incidents of disruptive behavior. Although the show operator will certainly stop the show for a disruption in the audience, we would prefer that the group leaders control the behavior of their own group.

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7. VISITING THE STAR STORE. If your group plans to visit the Star Store gift shop, please do not allow everyone into the store at once. If you have over 20 students, allow only 10 or 15 students in the store at a time. We also ask that only children with spending money be allowed into the store. This lessens the handling of the merchandise and prevents it from becoming soiled or damaged. We would also appreciate that one teacher or chaperon remain in the gift shop to help maintain order with their group.

8. HAVING LUNCH. With prior notification, the Cernan Center can usually arrange to have Triton College set aside tables on which your group can eat their own bag lunches. Groups can also pre-arrange with the Triton College cafeteria to purchase lunch packages. If your group has reserved this lunch area, we recommend that your group keep the lunches together in boxes or large bags rather than having the students carry them individually. As long as your lunches are in some sort of container, we will be able to provide an area for them to be stored while you are in the dome theater. A staff member will provide you with a campus map to direct your group to the Triton College cafeteria, which is a five-minute walk from the Cernan Center.

9. ANY QUESTIONS? We pride ourselves in offering friendly, personalized service, so if you have any questions pertaining to your trip to the Cernan Center, just give us a call at **(708) 456-0300, Ext. 3372** and we'll be happy to answer them. You can also contact one of our staff astronomers if you have a question related to astronomy, space science or earth science.

WE LOOK FORWARD TO SEEING YOUR GROUP AT THE CERNAN EARTH AND SPACE CENTER!

VISIT THE CERNAN CENTER ONLINE!

Visit the Cernan Center online at: **www.triton.edu/cernan**. To shop our Yahoo! Store online, please visit: **shop.store.yahoo.com/cescstarstore/index.html**. You can also e-mail one of our staff astronomers if you have a question related to astronomy, space science or earth science at: **cernan@triton.edu**.

For more information about the Cernan Center, its programs, field trips or events, please call (708) 456-0300, Ext. 3372. For public program information, please call our Program Line at (708) 583-3100.

Earth and Space Exhibits

The Cernan Earth and Space Center has a number of earth and space exhibits in its main lobby, as follows:

APOLLO / MARS LANDSCAPE DIORAMA

This large exhibit, covered by a plastic dome, is a two part exhibit. One half of the exhibit commemorates the successful Apollo missions to the moon, while the other half celebrates the present and future exploration of Mars. The Apollo side of the diorama contains models of the lunar module (the Apollo spacecraft that brought two astronauts to the lunar surface each mission) and the lunar rover, which astronauts used in the final three Apollo missions (15, 16 and 17) to extend the range of their lunar explorations. The Mars side of the diorama re-creates the rocky and sandy Martian landscape, complete with scale model of the Sojourner probe.

APOLLO 10 SPACE SUIT

This was the space suit worn by astronaut Gene Cernan on the Apollo 10 mission. This space suit was never worn on the moon, since the Apollo 10 mission was not designed to land astronauts on the surface. Instead, this mission served as the final "dress rehearsal" before the first lunar landing mission of Apollo 11 two months later.

OTHER APOLLO ARTIFACTS

This case contains a variety of Apollo artifacts, including the gloves worn by astronaut Harrison Schmitt (who explored the lunar surface with Gene Cernan on Apollo 17), a coverall garment worn by Gene Cernan en route to the moon and several pieces of Apollo spacecraft navigation equipment.

EARTH VIEW EXHIBIT

This computer generated video exhibit, which updates every five minutes, displays a world map that shows the current day and night hemispheres, along with the locations on earth that have the sun directly overhead and the moon directly overhead.

DOPPLER WEATHER RADAR

On days when there is rain or snow in the Midwest, the Doppler Weather Radar exhibit displays the intensity and movement of this precipitation.

"MOON SHADOWS" EXHIBIT

This interactive exhibit uses a model of the earth-moon system to assist viewers in understanding the phases of the moon. By looking through an eyepiece built into the exhibit, viewers can observe how the moon phase changes as they manipulate the position of the moon along its orbit.

TELESCOPE EXHIBIT

This exhibit shows cutaway models of the major types of telescopes and describes a few of the many celestial objects that can be seen with small telescopes.

DINOSAUR FOOTPRINT

This is a full-scale model of a footprint and lower leg bone of a Brachiosaurus that illustrates the size of these great prehistoric animals. This is not a real footprint, nor was this the footprint from a dinosaur found locally. No dinosaur bones have ever been found in northern Illinois due to the fact that glaciers from the last Ice Age "scoured away" any dinosaur fossils that may have once existed.

FOSSIL EXHIBIT

This exhibit displays a wide variety of Illinois fossils including our state fossil, the "Tully Monster."

SPACE EXPLORATION EXHIBIT

This exhibit displays information about the Hubble Space Telescope and other unmanned spacecraft and some of the recent astronomical discoveries that they have made.

CURRENT EVENTS BULLETIN BOARD

This bulletin board contains a current sky map; the latest astronomical images from the Hubble Space Telescope; and news stories featuring recent scientific discoveries, often obtained the same day from Internet sources.

OUTDOOR EXHIBITS

The Nike Tomahawk missile was used to collect weather information in the earth's upper atmosphere. The Apollo Practice Capsule never flew in space, but was used by the U.S. Navy to practice ocean recoveries.

The Cernan Earth and Space Center also offers an **Exhibit Hunt handout** that can be distributed to each student before or after their scheduled program(s). To complete the Exhibit Hunt, students must find answers to the questions among the artifacts and text panels throughout the Cernan Center's lobby exhibit area. The activity takes approximately 20 to 30 minutes to complete.

If you'd like to arrange an Exhibit Hunt for your students, please let the Cernan Center know before your scheduled visit.

The Cernan Center's exhibits are subject to change. Any changes to the exhibit area will be posted to the Cernan Earth and Space Center Online, which can be found at: **http://www.triton.edu/cernan**. Click on "Exhibits" to access this information.

The StarGazer

This is the Cernan Center program that you made a reservation to see. Below is some basic information about the show that should help you prepare your class for their upcoming visit.

Show title: *The StarGazer*
Grade Level: 7th grade and up
Length: 45 minutes

Summary of show:

The StarGazer is a multimedia program that combines stars, video, panoramic scenes, planetarium special effects and numerous astronomical photographs to illustrate the science of stars and the deeper meaning that astronomy holds for all of us. Nichelle Nichols (who played Lieutenant Uhura in the original Star Trek series) and Dr. James Kaler (Professor of Astronomy from the University of Illinois-Urbana) narrate this three-part personal look at astronomy.

The show begins with a child's curiosity of the sky. At the age of eight, Jim Kaler had a conversation with his grandmother about the nature of the stars that he saw each clear night. In that conversation, young Jim Kaler not only learned from her that stars are actually round, not star-shaped, but he also took his first steps toward becoming an astronomer. In subsequent observations of the nighttime sky, he began to recognize that stars vary in their color as well as their brightness. He also "discovered" that some of the brightest stars are not really stars at all – they are planets. At the age of 12, Jim Kaler recognized Jupiter in the starry background and realized that because Jupiter takes twelve years to orbit the sun, its current location was the same as its location at the time of his birth. A year after that, Jim bought his first telescope, and despite the limitations of that tiny instrument, he found a number of stellar treasures, including the Ring Nebula, a ghostly smoke ring that is actually the expanding shell of gas from a dying star. His small telescope also revealed to him that our Milky Way galaxy is populated with countless, immense clouds of dust and gas, known as nebulae.

The StarGazer next discusses the science of gravity, light and the spectrum, and how we decipher the life cycle of the stars. James Kaler describes how an understanding of gravity is required to understand how star shines. He explains how a rocket overcomes the pull of gravity and that, while in orbit, the spacecraft is still falling, but its high speed counters the earth's gravitational pull. The spacecraft maintains a constant height above the earth's surface so long as it maintains this speed. In much the same way, the gravity of a star overcomes the tendency of a star to expand forever due to its high temperature. So long as the temperature and the mass of the star remain the same, it will maintain a certain size and color.

Next, the program explains how we can examine the light emitted by stars to determine their chemical composition and, by so doing, develop a way to classify stars. Black lines in the light spectra of stars, first discovered in the early 1800s, is the key to this understanding. Each star's spectra peaks at different colors, revealing their internal chemistry, temperature, and even their fate when their fuel runs out. Stars are grouped into several spectral classes, which are based on their

temperature. From the hottest stars (classified as O), the classes continue through B, A, F, G, K, and M, which is the coolest class of stars. Stars can also be classified by their luminosity, or the total output of radiation emitted into space. By plotting the luminosity of a star versus its temperature, astronomers construct what is known as the Hertzsprung-Russell diagram. The H-R Diagram, as it is often abbreviated, reveals that most stars are located along a curved line that starts in the upper left-hand corner and continues toward the lower right-hand corner of the graph. These are the Main Sequence stars, which represent the middle-aged and stable stars, including our own Sun. When stars begin to run out of fuel, they die, but not all stars die in the same fashion. Smaller stars like our sun will swell to a larger size and then gradually collapse. Larger, more massive, stars often die violent deaths, resulting in supernova explosions and sometimes ending their existence as black holes, which are briefly described in the program.

Finally, the program concludes by reflecting upon the deeper meaning of astronomy in our own lives. Dr. Kaler explains that although he is fascinated with the science of stargazing, he also recognizes how the stars can affect our lives. The parallel between the lives of stars and the lives of us humans is a profound discovery, and he encourages everyone to "be the star gazer that is within you."

After *The StarGazer* has concluded, the Cernan Center show operator will use the star projector to show audiences the current night sky and the major stars, constellations and planets that can be seen on the next clear night. A brief question-and-answer period follows this live segment of the presentation.

Pre-visit Preparation:

Like all the dome theater shows presented at the Cernan Center, no preparations are needed for students to enjoy and learn from their visit. If, however, you would like to conduct some pre-visit class discussions, you can start by using information contained in the "Summary of Show" and/or the "Post-visit Activities" sections of this Teacher's Guide.

Post-visit Activities:

After your visit to the Cernan Center, you may wish to discuss one or more of the following topics with your class, or perhaps have your students research the topics themselves and prepare a report or oral presentation.

- What are the stars made of? How far away are they? How are stars similar and different from one another? What types of stars are more likely to have planets that support life?

- By connecting the stars into different shapes, constellations are made. What ancient civilization developed many of the constellations we see today? What are some of the myths and stories behind these celestial figures?

- What else is found in space besides stars? What is a galaxy and approximately how many are

there in the universe?

- Have your students describe the different types of instruments that astronomers use to explore space, including optical telescopes, radio telescopes, and unmanned probes.

- Have your students research the different ways that stars die and the byproducts that result from their deaths, including white dwarfs (which result from small stars) to the neutron stars and black holes that result when massive stars die.

- Ask your students to research the "Big Bang" theory and describe its major characteristics. Have them describe (either orally or in writing) whether they believe in the "Big Bang" theory and why (or why not) they believe it to be true.

- Have your students discuss any personal "discoveries" or nighttime sky watching that they have done on their own or with their families, scout packs, etc. What were some of the things you saw? Did the student have binoculars or a telescope to enhance their observing?

- Everything in space moves. Learn about rotation, revolution and gravity. What are some typical speeds that celestial bodies move in space? (e.g. the earth spins at the rate of about 1,000 miles per hour, and it's circling the sun at a speed of approximately 66,000 miles per hour)

- Research the time needed for each planet to orbit the sun, and calculate your age on each of the other planets. To assist this effort, you can visit the Exploratorium's "Your Age on Other Worlds" web page, at **http://www.exploratorium.edu/ronh/age/index.html**.

- Discuss the characteristics of gravity, and calculate your weight on the other planets. To assist this effort, you can visit the Exploratorium's "Your Weight on Other Worlds" web page, located at **http://www.exploratorium.edu/ronh/weight/index.html**.

- Obtain a Hertzsprung-Russell diagram (from an astronomy textbook or via the Internet) and discuss the significance of each component – that is, the temperature of the star on its x-axis, the luminosity of the star on its y-axis, the curving line of Main Sequence stars, the other stars that are off the Main Sequence, etc.

- Once each month, the Cernan Center sponsors a *Monthly Skywatch* program on a Saturday night, which discusses the current night sky and what can be observed. Afterwards, the public is invited to look through telescopes set up on the front lawn of the Cernan Center (weather permitting) to observe for themselves the visible planets, craters on the moon and other celestial objects. If students don't have access to a telescope, they can always attend a *Monthly Skywatch* to look through ours. Call the Cernan Center at **(708) 583-3100** or visit our website at **http://www.triton.edu/cernan** for upcoming dates.

Teacher Resource Pages

Whether your class is studying astronomy, dinosaurs or earth science, the dome theater programs offered by the Cernan Earth and Space Center serve as an excellent supplement to your classroom instruction. However, if you would like to further research your subject area, or are looking for additional information on the topics presented in our shows, please refer to the following list:

ASTRONOMY AND SPACE SCIENCE

A wide variety of online resources can be found at the Cernan Center's Astronomy/Space Links page by visiting www.triton.edu/cernan and clicking on "Space Links."

NASA -- Educational materials including fact sheets, newsletters, slides, and videotapes.

1. NASA Educator Resource Center; Museum of Science and Industry; 57th Street & Lake Shore Drive; Chicago, IL 60637. Phone: (773) 684-9844, Ext. 2426. FAX: (773) 684-5580.
Website: **www.msichicago.org**. It has an extensive NASA video collection. Copies available free of charge if you provide blank tape. Many other resource materials available.

2. NASA Glenn Research Center; NASA Educator Resource Center; 21000 Brookpark Rd., MS 8-1; Cleveland, OH 44135. Phone: (216) 433-2017. FAX: (216) 433-3601.
Website: **www.grc.nasa.gov/WWW/PAO/html/edteachr.htm**. NASA Teacher Resource Centers are established to provide educators with NASA-related educational materials for use in the classroom. These materials can be references or duplicated at the Center; they include classroom activities, lesson plans, teacher guides, laser disks, slides, audio and video tapes. Most materials and services are also available at Chicago's Museum of Science and Industry.

3. "Report to Educators" Free quarterly periodical about NASA for educational use. Request subscription on school letterhead by writing:

NASA Report to Educators
Education Affairs Division
Code XE
NASA
Washington, D.C. 20546

ASTRONOMICAL SOCIETY OF THE PACIFIC – "The Universe in the Classroom." A quarterly newsletter on teaching astronomy. Request free subscription by completing the electronic subscription form at **www.astrosociety.org/education/publications/tnl/tnl.html.**

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PERIODICALS:

1. SKY AND TELESCOPE Magazine. Monthly periodical. For subscription information, please write or call:

Sky Publishing Corporation
49 Bay State Road
Cambridge, MA 02138
(800) 253-0245 Website: **skyandtelescope.com**

2. ASTRONOMY Magazine. Monthly periodical. For subscription information, please write or call:

Kalmbach Publishing Co.
21027 Crossroads Circle
P.O. Box 1612
Waukesha, WI 53187
(800) 533-6644 Website: **www.astronomy.com**

3. ABRAMS SKY CALENDAR. Monthly sky map and astronomy events calendar. For subscription information, please write:

Abrams Sky Calendar
Abrams Planetarium
Michigan State University
East Lansing, Michigan 48824
Website: **www.pa.msu.edu/abrams/SkyCalendar/Index.html**

4. ODYSSEY Magazine. Children's monthly astronomy periodical. For subscription information, please write:

Cobblestone Publishing Company
30 Grove Street, Suite C
Peterborough, NH 03458
(800) 821-0115 Website: **www.odysseymagazine.com**

Please help us keep our information current. If you discover an address, phone number, or Internet address in our Teacher's Resource Pages that has changed, please inform the Cernan Center at **(708) 456-0300, Ext. 3372.** Thank you very much.

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EARTH SCIENCE

A wide variety of online resources can be found at the Cernan Center's Earth Science Links page by visiting www.triton.edu/cernan and clicking on "Earth Links."

DINOSAURS:

The best local resource for educators is the Field Museum of Natural History in Chicago. Call (312) 922-9410 and ask for the Teacher Resource Department. Website: **www.fmnh.org**

GEOLOGY:

U.S. Geological Survey (USGS) Website: **www.usgs.gov**
Boulder, Colorado

WEATHER:

National Climatic Data Center Website: **lwf.ncdc.noaa.gov/oa/ncdc.html**
NOAA Environmental Data Services
Federal Building
Asheville, North Carolina 28801

National Weather Service Website: **www.nws.noaa.gov**
Public Affairs Office
Silver Springs, Maryland
(301) 899-3296

Illinois Emergency Services and Disaster Agency
100 E. Adams
Springfield, Illinois 62706
(217) 782-2700

MISCELLANEOUS:

National Geographic Society Website: **www.nationalgeographic.com**
Educational Services
Department 38
Washington, D.C. 20036
(800) 368-2728

Please help us keep our information current. If you discover an address, phone number, or Internet address in our Teacher's Resource Pages that has changed, please inform the Cernan Center at **(708) 456-0300, Ext. 3372.** Thank you very much.