Correlation of STARLAB Cylinders to the National Science Education Standards Grades 5-8

The National Science Education Standards establish a series of goals designed to improve the scientific literacy of American students. In developing the standards, one of the main goals was to focus on the inquiry aspects of science education rather than just the content that is taught. Since its inception more than 25 years ago, the main focus of the STARLAB Planetarium system has been just that. Instead of simply being a place where students can "see the sky", the various STARLAB cylinders that are used with the analog Standard and FiberArc STARLAB projectors were developed with the concept of student participation as a central theme. Since many state education departments and school districts use the National Science Education Standards as a framework for creating their core curricula in science, we offer the following correlation between the STARLAB cylinders and the standards.

The following pages show which STARLAB cylinders can be used to help students meet each of the National Science Education Standards. We have included the correlations with the Content Standards including Science as Inquiry, Physical Science, Life Science, Earth and Space Science, Science and Technology, Science in Personal and Social Perspectives, and History and Nature of Science.

5-8 Science As Inquiry — Cylinder Key:

SP1 = Milky Way Starfield
SP4 = Deep Sky Objects
SP5 = Solar System/Galaxy
SP7 = Radio Sky
SP8 = Moon
ES2 = Plate Tectonics
ES3 = Ocean Currents
ES4 = Weather
SS2 = Lewis & Clark Celestial Navigation
OS1 = Biological Cell

5-8 Science as Inquiry Standards and the corresponding STARLAB Cylinders that help meet those standards

Understandings About Scientific Inquiry	SP1	SP4	SP5	SP7	SP8	ES2	ES3	ES4	SS2	OS1
Different kinds of questions suggest different kinds of scientific investigations. Some investigations involve observing and describing objects, organisms, or events; some involve collecting specimens; some involve experiments; some involve seeking more information; some involve discovery of new objects and phenomena; and some involve making models.	✔	✔	✔	✔	✔	✔	✔	✔		✔
Mathematics is important in all aspects of scientific inquiry.			✔						✔	
Technology used to gather data enhances accuracy and allows scientists to analyze and quantify results of investigations.	✔	✔	✔	✔	✔	✔	✔	✔		✔
Scientific explanations emphasize evidence, have logically consistent arguments, and use scientific principles, models, and theories. The scientific community accepts and uses such explanations until displaced by better scientific ones. When such displacement occurs, science advances.	✔	✔	✔	✔	✔	✔	✔	✔		✔

5-8 Science As Inquiry — Cylinder Key:

SP1 = Milky Way Starfield SP4 = Deep Sky Objects SP5 = Solar System/Galaxy SP7 = Radio Sky SP8 = Moon
ES2 = Plate Tectonics ES3 = Ocean Currents ES4 = Weather SS2 = Lewis & Clark Celestial Navigation
OS1 = Biological Cell

Understandings About Scientific Inquiry (cont'd)	SP1	SP4	SP5	SP7	SP8	ES2	ES3	ES4	SS2	OS1
Science advances through legitimate skepticism. Asking questions and querying other scientists' explanations is part of scientific inquiry. Scientists evaluate the explanations proposed by other scientists by examining evidence, comparing evidence, identifying faulty reasoning, pointing out statements that go beyond the evidence, and suggesting alternative explanations for the same observations.	✔	✔	✔	✔	✔	✔	✔	✔		✔
Scientific investigations sometimes result in new ideas and phenomena for study, generate new methods or procedures for an investigation, or develop new technologies to improve the collection of data. All of these results can lead to new investigations.	✔	✔	✔	✔	✔	✔	✔	✔		✔

5-8 Physical Science — Cylinder Key:

SP1 = Milky Way Starfield SP5 = Solar System/Galaxy SP7 = Radio Sky ES2 = Plate Tectonics ES3 = Ocean Currents
ES4 = Weather OS1 = Biological Cell

5-8 Physical Science Standards and the corresponding STARLAB Cylinders that help meet those standards

Motions and Forces	SP1	SP5	SP7	ES2	ES3	ES4	OS1
The motion of an object can be described by its position, direction of motion, and speed. That motion can be measured and represented on a graph.				✔			
Transfer of Energy							
Energy is a property of many substances and is associated with heat, light, electricity, mechanical motion, sound, nuclei, and the nature of a chemical. Energy is transferred in many ways.	✔	✔		✔	✔	✔	✔
In most chemical and nuclear reactions, energy is transferred into or out of a system. Heat, light, mechanical motion, or electricity might all be involved in such transfers.	✔	✔					✔
The sun is a major source of energy for changes on the earth's surface. The sun loses energy by emitting light. A tiny fraction of that light reaches the earth, transferring energy from the sun to the earth. The sun's energy arrives as light with a range of wavelengths, consisting of visible light, infrared, and ultraviolet radiation.	✔	✔	✔	✔	✔	✔	

5-8 Life Science — Cylinder Key:

ES2 = Plate Tectonics OS1 = Biological Cell OS2 = Bird Migration

5-8 Life Science Standards and the corresponding STARLAB Cylinders that help meet those standards			
Structure and Function in Living Systems	ES2	OS1	OS2
Living systems at all levels of organization demonstrate the complementary nature of structure and function. Important levels of organization for structure and function include cells, organs, tissues, organ systems, whole organisms, and ecosystems.		✔	
All organisms are composed of cells — the fundamental unit of life. Most organisms are single cells; other organisms, including humans, are multicellular.		✔	
Cells carry on the many functions needed to sustain life. They grow and divide, thereby producing more cells. This requires that they take in nutrients, which they use to provide energy for the work that cells do and to make the materials that a cell or an organism needs.		✔	
Reproduction and Heredity			
Reproduction is a characteristic of all living systems; because no individual organism lives forever, reproduction is essential to the continuation of every species. Some organisms reproduce asexually. Other organisms reproduce sexually.		✔	
Every organism requires a set of instructions for specifying its traits. Heredity is the passage of these instructions from one generation to another.		✔	
Hereditary information is contained in genes, located in the chromosomes of each cell. Each gene carries a single unit of information. An inherited trait of an individual can be determined by one or by many genes, and a single gene can influence more than one trait. A human cell contains many thousands of different genes.		✔	
Regulation and Behavior			
All organisms must be able to obtain and use resources, grow, reproduce, and maintain stable internal conditions while living in a constantly changing external environment.			✔
Behavior is one kind of response an organism can make to an internal or environmental stimulus. A behavioral response requires coordination and communication at many levels, including cells, organ systems, and whole organisms. Behavioral response is a set of actions determined in part by heredity and in part from experience.			✔
An organism's behavior evolves through adaptation to its environment. How a species moves, obtains food, reproduces, and responds to danger are based in the species' evolutionary history.			✔
Diversity and Adaptations of Organisms			
Millions of species of animals, plants, and microorganisms are alive today. Although different species might look dissimilar, the unity among organisms becomes apparent from an analysis of internal structures, the similarity of their chemical processes, and the evidence of common ancestry.		✔	
Extinction of a species occurs when the environment changes and the adaptive characteristics of a species are insufficient to allow its survival. Fossils indicate that many organisms that lived long ago are extinct. Extinction of species is common; most of the species that have lived on the earth no longer exist.	✔		

5-8 Earth and Space Science — Cylinder Key:

SP1 = Milky Way Starfield
SP5 = Solar System/Galaxy
SP8 = Moon
ES2 = Plate Tectonics
ES3 = Ocean Currents
ES4 = Weather
OS1 -= Biological Cell

5-8 Earth and Space Science Standards and the corresponding STARLAB Cylinders that help meet those standards							
Structure of the Earth System	SP1	SP5	SP8	ES2	ES3	ES4	OS1
The solid earth is layered with a lithosphere; hot, convecting mantle; and dense, metallic core.				✔			
Lithospheric plates on the scales of continents and oceans constantly move at rates of centimeters per year in response to movements in the mantle. Major geological events, such as earthquakes, volcanic eruptions, and mountain building, result from these plate motions.				✔			
Land forms are the result of a combination of constructive and destructive forces. Constructive forces include crustal deformation, volcanic eruption, and deposition of sediment, while destructive forces include weathering and erosion.				✔			
Some changes in the solid earth can be described as the "rock cycle." Old rocks at the earth's surface weather, forming sediments that are buried, then compacted, heated, and often recrystallized into new rock. Eventually, those new rocks may be brought to the surface by the forces that drive plate motions, and the rock cycle continues.				✔			
Water, which covers the majority of the earth's surface, circulates through the crust, oceans, and atmosphere in what is known as the "water cycle." Water evaporates from the earth's surface, rises and cools as it moves to higher elevations, condenses as rain or snow, and falls to the surface where it collects in lakes, oceans, soil, and in rocks underground.						✔	
Clouds, formed by the condensation of water vapor, affect weather and climate.						✔	
Global patterns of atmospheric movement influence local weather. Oceans have a major effect on climate, because water in the oceans holds a large amount of heat.					✔	✔	
Earth's History							
The earth processes we see today, including erosion, movement of lithospheric plates, and changes in atmospheric composition, are similar to those that occurred in the past. Earth history is also influenced by occasional catastrophes, such as the impact of an asteroid or comet.		✔		✔			
Fossils provide important evidence of how life and environmental conditions have changed.				✔			
Earth in the Solar System							
The earth is the third planet from the sun in a system that includes the moon, the sun, eight other planets and their moons, and smaller objects, such as asteroids and comets. The sun, an average star, is the central and largest body in the solar system.		✔	✔				
Most objects in the solar system are in regular and predictable motion. Those motions explain such phenomena as the day, the year, phases of the moon, and eclipses.	✔	✔	✔				
Gravity is the force that keeps planets in orbit around the sun and governs the rest of the motion in the solar system. Gravity alone holds us to the earth's surface and explains the phenomena of the tides.		✔	✔				
The sun is the major source of energy for phenomena on the earth's surface, such as growth of plants, winds, ocean currents, and the water cycle. Seasons result from variations in the amount of the sun's energy hitting the surface, due to the tilt of the earth's rotation on its axis and the length of the day.	✔	✔			✔	✔	✔

5-8 Science and Technology — Cylinder Key:

SP1 = Milky Way Starfield
SP4 = Deep Sky Objects
SP5 = Solar System/Galaxy
SP7 = Radio Sky
SP8 = Moon
ES2 = Plate Tectonics
ES3 = Ocean Currents
ES4 = Weather
SS2 = Lewis & Clark Celestial Navigation
OS1 = Biological Cell

5-8 Science and Technology Standards and the corresponding STARLAB Cylinders that help meet those standards

Understandings About Science and Technology	SP1	SP4	SP5	SP7	SP8	ES2	ES3	ES4	SS2	OS1
Science and technology are reciprocal. Science helps drive technology, as it addresses questions that demand more sophisticated instruments and provides principles for better instrumentation and technique. Technology is essential to science, because it provides instruments and techniques that enable observations of objects and phenomena that are otherwise unobservable due to factors such as quantity, distance, location, size, and speed. Technology also provides tools for investigations, inquiry, and analysis.	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
Perfectly designed solutions do not exist. All technological solutions have trade-offs, such as safety, cost, efficiency, and appearance. Engineers often build in back-up systems to provide safety. Risk is part of living in a highly technological world. Reducing risk often results in new technology.					✔					
Technological designs have constraints. Some constraints are unavoidable, for example, properties of materials, or effects of weather and friction; other constraints limit choices in the design, for example, environmental protection, human safety, and aesthetics.					✔					
Technological solutions have intended benefits and unintended consequences. Some consequences can be predicted, others cannot.				✔	✔					✔

5-8 Science in Personal and Social Perspectives — Cylinder Key:

SP1 = Milky Way Starfield
SP5 = Solar System/Galaxy
SP7 = Radio Sky
SP8 = Moon
ES2 = Plate Tectonics
ES3 = Ocean Currents
ES4 = Weather
SS2 = Lewis & Clark Celestial Navigation
OS1 = Biological Cell

5-8 Science in Personal and Social Perspectives Standards and the corresponding STARLAB Cylinders that help meet those standards

Populations, Resources, and Environments	SP1	SP5	SP7	SP8	ES2	ES3	ES4	SS2	OS1
When an area becomes overpopulated, the environment will become degraded due to the increased use of resources.								✔	
Natural Hazards									
Internal and external processes of the earth system cause natural hazards, events that change or destroy human and wildlife habitats, damage property, and harm or kill humans. Natural hazards include earthquakes, landslides, wildfires, volcanic eruptions, floods, storms, and even possible impacts of asteroids.					✔		✔		
Human activities also can induce hazards through resource acquisition, urban growth, land-use decisions, and waste disposal. Such activities can accelerate many natural changes.								✔	
Risks and Benefits									
Risk analysis considers the type of hazard and estimates the number of people that might be exposed and the number likely to suffer consequences. The results are used to determine the options for reducing or eliminating risks.					✔		✔		
Science and Technology in Society									
Science and technology have advanced through contributions of many different people, in different cultures, at different times in history. Science and technology have contributed enormously to economic growth and productivity among societies and groups within societies.	✔	✔	✔	✔	✔	✔	✔		✔
Scientists and engineers work in many different settings, including colleges and universities, businesses and industries, specific research institutes, and government agencies.	✔	✔	✔	✔	✔	✔	✔		✔
Science cannot answer all questions and technology cannot solve all human problems or meet all human needs. Students should understand the difference between scientific and other questions. They should appreciate what science and technology can reasonably contribute to society and what they cannot do. For example, new technologies often will decrease some risks and increase others.	✔	✔	✔	✔	✔	✔	✔		✔

5-8 History and Nature of Science — Cylinder Key:

SP1 = Milky Way Starfield
SP3 = Constellations
SP4 = Deep Sky Objects
SP5 = Solar System/Galaxy
SP7 = Radio Sky
SP8 = Moon
MY1 = Greek Mythology
MY2 = African Mythology
MY3 = Ancient Egyptian Mythology
MY4 = Native American Mythology
MY5 = Navajo Skies
MY6 = Ancient Chinese Legends
MY7 = Ancient Chinese Seasons
MY8 = Lapp/Samí Mythology
MY9 = Hindu Mythology
MY10 = Inuit Starlore
SS1 = Maya Skies
SS3 = Civil War Sky
SS4 = Polynesian Voyaging
ES2 = Plate Tectonics
ES3 = Ocean Currents
ES4 = Weather
OS1 = Biological Cell
OS2 = Bird Migration

5-8 History and Nature of Science Standards and the corresponding STARLAB Cylinders that help meet those standards									
Science as a Human Endeavor	SP1	SP4	SP5	SP7	SP8	ES2	ES3	ES4	OS1
Science requires different abilities, depending on such factors as the field of study and type of inquiry. Science is very much a human endeavor, and the work of science relies on basic human qualities, such as reasoning, insight, energy, skill, and creativity--as well as on scientific habits of mind, such as intellectual honesty, tolerance of ambiguity, skepticism, and openness to new ideas.	✔	✔	✔	✔	✔	✔	✔	✔	✔
Nature of Science									
Scientists formulate and test their explanations of nature using observation, experiments, and theoretical and mathematical models. Although all scientific ideas are tentative and subject to change and improvement in principle, for most major ideas in science, there is much experimental and observational confirmation. Those ideas are not likely to change greatly in the future. Scientists do and have changed their ideas about nature when they encounter new experimental evidence that does not match their existing explanations.	✔	✔	✔	✔	✔	✔	✔	✔	✔
In areas where active research is being pursued and in which there is not a great deal of experimental or observational evidence and understanding, it is normal for scientists to differ with one another about the interpretation of the evidence or theory being considered. Different scientists might publish conflicting experimental results or might draw different conclusions from the same data. Ideally, scientists acknowledge such conflict and work towards finding evidence that will resolve their disagreement.	✔	✔	✔	✔	✔	✔	✔	✔	✔
It is part of scientific inquiry to evaluate the results of scientific investigations, experiments, observations, theoretical models, and the explanations proposed by other scientists. Evaluation includes reviewing the experimental procedures, examining the evidence, identifying faulty reasoning, pointing out statements that go beyond the evidence, and suggesting alternative explanations for the same observations. Although scientists may disagree about explanations of phenomena, about interpretations of data, or about the value of rival theories, they do agree that questioning, response to criticism, and open communication are integral to the process of science. As scientific knowledge evolves, major disagreements are eventually resolved through such interactions between scientists.	✔	✔	✔	✔	✔	✔	✔	✔	✔

5-8 History and Nature of Science — Cylinder Key:

SP1 = Milky Way Starfield
SP3 = Constellations
SP4 = Deep Sky Objects
SP5 = Solar System/Galaxy
SP7 = Radio Sky
SP8 = Moon
MY1 = Greek Mythology
MY2 = African Mythology
MY3 = Ancient Egyptian Mythology
MY4 = Native American Mythology
MY5 = Navajo Skies
MY6 = Ancient Chinese Legends
MY7 = Ancient Chinese Seasons
MY8 = Lapp/Samí Mythology
MY9 = Hindu Mythology
MY10 = Inuit Starlore
SS1 = Maya Skies
SS3 = Civil War Sky
SS4 = Polynesian Voyaging
ES2 = Plate Tectonics
ES3 = Ocean Currents
ES4 = Weather
OS1 = Biological Cell
OS2 = Bird Migration

Nature of Science (cont'd)	SP 1	SP 3	SP 5	SP 7	SP 8	MY 1	MY 2	MY 3	MY 4	MY 5	MY 6	MY 7	MY 8	MY 9	MY 10	SS 1	SS 3	SS 4	ES 2	ES 3	ES 4	OS 1	OS 2
Students should understand the difference between scientific and other questions and what science and technology can and cannot reasonably contribute to society.	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔

History of Science	SP1	SP4	SP5	SP7	SP8	ES2	ES3	ES4	OS1
Many individuals have contributed to the traditions of science. Studying some of these individuals provides further understanding of scientific inquiry, science as a human endeavor, the nature of science, and the relationships between science and society.	✔	✔	✔	✔	✔	✔	✔		✔
In historical perspective, science has been practiced by different individuals in different cultures. In looking at the history of many peoples, one finds that scientists and engineers of high achievement are considered to be among the most valued contributors to their culture.	✔	✔	✔	✔	✔	✔	✔		✔
Tracing the history of science can show how difficult it was for scientific innovators to break through the accepted ideas of their time to reach the conclusions that we currently take for granted.	✔	✔	✔	✔	✔	✔	✔		✔