National Science Education Standards **Content Standards: Grades 5-8**	**Related Features of Alien Rescue**

CONTENT STANDARD A: SCIENCE AS INQUIRY	
• **Abilities Necessary to Scientific Inquiry**	
Identify questions that can be answered through scientific investigations.	Students generate a variety of types of questions, e.g. 1. Which worlds have sulfur in their atmospheres? 2. Do all the gas giants have a magnetic field?
Design and conduct a scientific investigation.	Students must determine the process they will use to attack the problem
Use appropriate tools and techniques to gather, analyze, and interpret data.	Students use the databases and probe design room to collect information, and the control room to analyze and interpret it.
Develop descriptions, explanations, predictions, and models using evidence.	Students are assigned the task of writing a rationale for their solutions. A requirement for this assignment is the inclusion of evidence to support their recommendations.
Think critically and logically to make the relationships between evidence and explanations.	Students are required to provide explanations for their decisions based on the information they gather during their research.
Recognize and analyze alternative explanations and predictions.	Because students debate their findings and hypotheses with classmates during whole class discussions, they recognize and analyze alternative viewpoints.
Communicate scientific procedures and explanations.	The teacher questions students' activities in class discussions and during one-on-one interviews and supports them in articulating their reasons for their procedures.
Use mathematics in all aspects of scientific inquiry.	Students use mathematics to convert temperature scales and other units of measurement. They also convert fractions to decimals

• **Understandings**	
Different kinds of questions suggest different kinds of scientific investigations.	Students formulate many questions related to the development of a solution. Some of these questions can be answered by searching existing knowledge bases and others can only be answered by gathering additional information through probe missions.
Mathematics is important in all aspects of scientific inquiry.	Students use mathematical skills to convert among temperature scales and between fractions and decimals. They generate the need for these skills as they gather information; which supports their development of the belief that mathematics is an important tool during scientific inquiry.
Technology used to gather data enhances accuracy and allows scientists to analyze and quantify results of investigations.	Students send probes to worlds to gather data unavailable without technology.
Scientific explanations emphasize evidence, have logically consistent arguments, and use scientific principles, models, and theories.	Students explain their reasons for their hypotheses and choices using evidence and scientific principles.
Asking questions and querying other scientists' explanations is part of scientific inquiry. Scientists evaluate the explanations proposed by other scientists by examining evidence, identifying faulty reasoning, pointing out statements that go beyond the evidence, and suggesting alternative explanations for the same observations.	Working in whole class settings, students present their own ideas and discuss and evaluate the ideas of their classmates. The classroom teacher models such cognitive skills as identifying faulty reasoning and suggesting alternative explanations, then coaches students to use these skills to examine the alternative viewpoints presented.

CONTENT STANDARD B: PHYSICAL SCIENCE	Related Features of Alien Rescue
• **Properties of Matter**	
A substance has characteristic properties, such as density, a boiling point, and solubility.	One characteristic of a substance is its spectra. Atmospheres have density.
• **Transfer of Energy**	
The sun is a major source of energy for changes on the earth's surface. The sun's energy arrives as light with a range of wavelengths, consisting of visible light, infrared, and ultraviolet radiation.	Students use spectra to identify elements; they recognize that every element has a spectral signature.

CONTENT STANDARD C: LIFE SCIENCES	Related Features of Alien Rescue
• **Regulation and Behavior**	
An organism's behavior evolves through adaptation to its environment. How a species moves, obtains food, reproduces, and responds to danger is based on the species' evolutionary history.	Students can discuss how an alien's body evolved through adaptation to the environment of its homeworld.
• **Populations and Ecosystems**	
All populations living together and the physical factors with which they interact compose an ecosystem.	The aliens bring with them the seeds of their ecosystem, which they can use to make a world habitable, if the physical factors of that world are suitable.
The number of organisms an ecosystem can support depends on the resources available and abiotic factors, such as quantity of light and water, range of temperatures, and soil composition.	Students choose which world is best suited to each alien species by examining factors such as temperature, soil composition, and atmospheric composition.
• **Diversity and Adaptations of Organisms**	
Extinction of a species occurs when the environment changes and the adaptive characteristics of a species are insufficient to allow its survival.	The aliens adapted to the demise of their solar system by building these lifeboats to carry them to new homes. Intelligence is an adaptation that can promote the survival of a species.

CONTENT STANDARD D: EARTH AND SPACE SCIENCE	Related Features of Alien Rescue
• **Structure of the Earth System**	
The solid earth is layered with a lithosphere, hot mantle, and dense, metallic core.	Students learn that Earth has a liquid metallic core. They recognize that some worlds do not, and they discuss the effect of this feature on a world in terms of seismic activity, cratering, and magnetic fields.
Major geological events, such as earthquakes, volcanic eruptions, and mountain building, result from these plate motions.	Students compare geological events on Earth with those on Io, a volatile world.
The atmosphere is a mixture of nitrogen, oxygen, and trace gases that include water vapor. The atmosphere has different properties at different elevations.	Students examine the atmospheric composition of other worlds.
• **Earth's History**	
Earth's history has been influenced by occasional catastrophes, such as the impact of an asteroid or comet.	The alien solar system was destroyed by a catastrophic event - a nearby star went supernova, emitting radiation that would eventually make their worlds uninhabitable.
• **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.	Students study the solar system in depth, examining and evaluating each world as a potential home to one of the alien species.
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.	Students compare the lengths of the planets'years and explain how the distance of a planet's orbit from the sun affects this length.
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.	Students compare the gravity of the alien worlds with that of the Earth, and learn of the effect of gravity on weight and livability.

CONTENT STANDARD E: SCIENCE AND TECHNOLOGY	Related Features of Alien Rescue
• **Abilities of Technological Design**	
Identify appropriate problems for technological design.	Some of the questions students identify cannot be answered through the use of existing knowledge bases. They identify which questions can be answered by sending probes to other worlds, then design these probes to gather the information they need.
Design a solution or product	The class as a whole is charged with the responsibility to develop a solution to the problem.
Implement a proposed design.	Students design probes that they can they send to other worlds to collect information. They design a solution plan and implement it.
Evaluate completed technological designs or products.	Students discuss their designs for probes with classmates. They explain the reasons for malfunctions and review their designs based on their success or failure to achieve desired ends. They review and evaluate the designs of others.
Communicate the process of technological design.	Because students work in groups, they must communicate their ideas about the process of design in order to do their work.
• **Understandings About Science and Technology**	
Technological solutions have side effects; technologies cost, carry risks, and provide benefits.	The global decision to help the aliens carries heavy risks but also offers benefits in the form of new technologies and medical advances. Students recognize that probes are expensive and that they must justify their designs.
Many different people in different cultures have made and continue to make contributions to science and technology.	Students learn about the history of some concepts that are now widely accepted, and of the people involved in the discovery or development of those concepts.
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 provides tools for investigations, inquiry,	Students use a wide range of scientific instruments, and recognize that some data would not be available without those instruments. For example, without the probes, students would be unable to gather accurate information on some worlds because of distance.

and analysis.	
Perfectly designed solutions do not exist. All technological solutions have trade-offs, such as safety, cost, efficiency, and appearance. Engineers often build backup systems to provide safety.	Students have limited funds for probe building, and must make trade-offs to maximize their resources. Students learn that previous probe missions experienced a variety of failures, and that backup systems may improve the likelihood of obtaining needed information.
Technological designs have constraints.	Students deal with the constraints of money and space in building probes.

CONTENT STANDARD F: SCIENCE IN PERSONAL AND SOCIAL PERSPECTIVES	**Related Features of Alien Rescue**
Risks and Benefits	
Individuals can use a systematic approach to thinking critically about risks and benefits. Examples include applying probability estimates to risks and comparing them to estimated personal and social benefits.	Students must develop a solution plan in the absence of complete information about the worlds in our solar system. They must consider the risks to the alien species involved in the choices they make.
Science and Technology in Society	
Societal challenges often inspire questions for scientific research, and social priorities often influence research priorities through the availability of funding for research.	The premise of the problem is that there has been a worldwide cooperative effort to fund the research necessary to help the aliens. Students are told that their funding for probe missions is limited.

CONTENT STANDARD G: HISTORY AND NATURE AND SCIENCE	**Related Features of Alien Rescue**
• **Science as a Human Endeavor**	
Women and men of various social and ethnic backgrounds engage in the activities of science, engineering, and related fields. Some scientists work in teams, and some work alone, but all communicate extensively with others.	Students work together as they see the value of collaboration. Students must communicate their ideas to their classmates and depend on their help to refine those ideas. Students must write convincing rationales for their decisions. Students discuss why scientists collaborate.
• **Nature of Science**	

Scientists 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.	Whole class interactions allow students to share their findings and hypotheses, and question those of other students. Disagreements are resolved through dialog and continue until consensus or a decision is reached.
• **History of Science**	
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.	The names of the individuals whose contributions support the work the students do are associated with that work in *Alien Rescue's* databases. Galileo and Goddard or two scientists students may discuss during *Alien Rescue.*