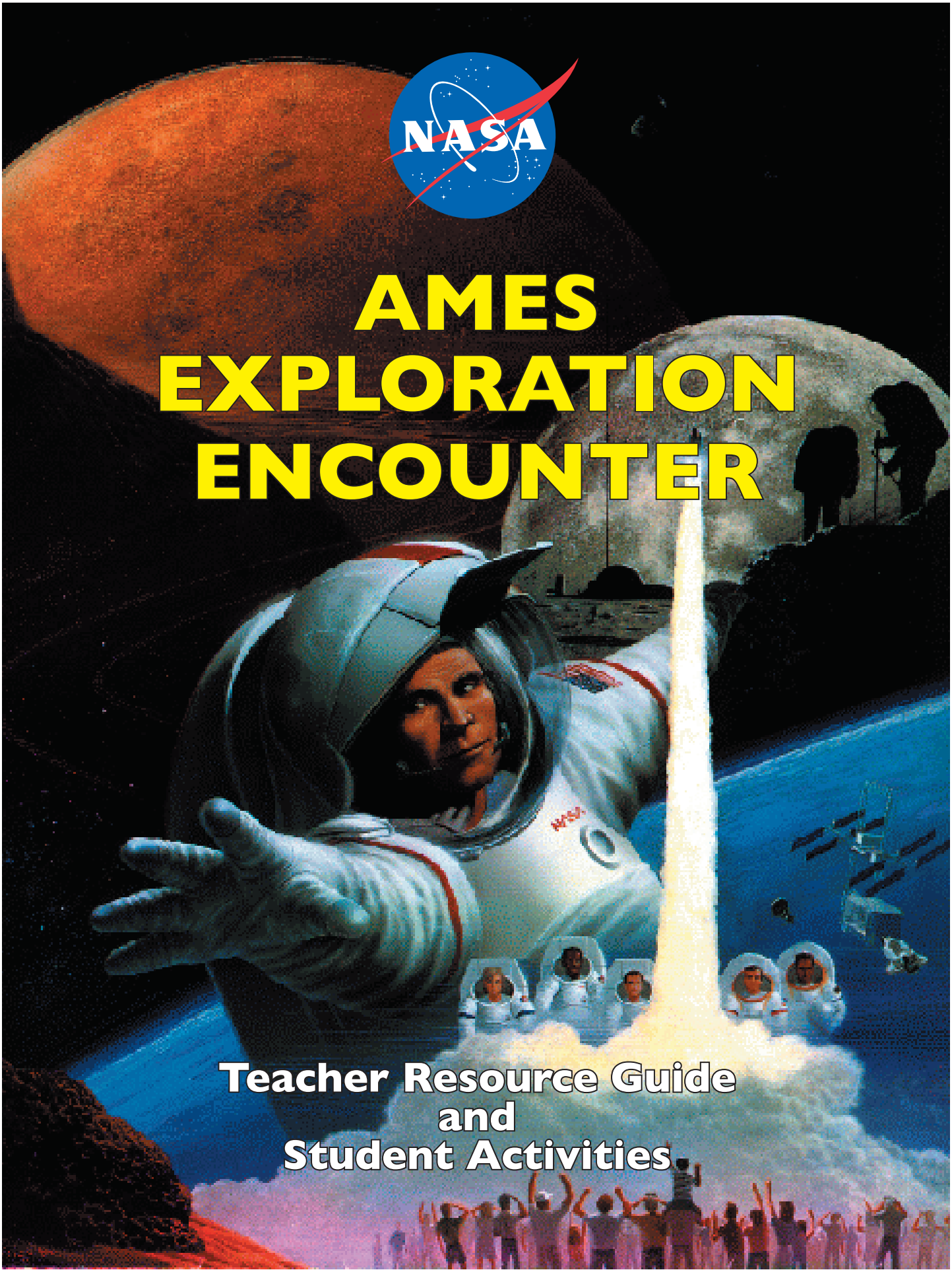
AMES EXPLORATION ENCOUNTER



Teacher Resource Guide and Student Activities

AMES EXPLORATION ENCOUNTER

Teacher Resource Guide and Student Activities

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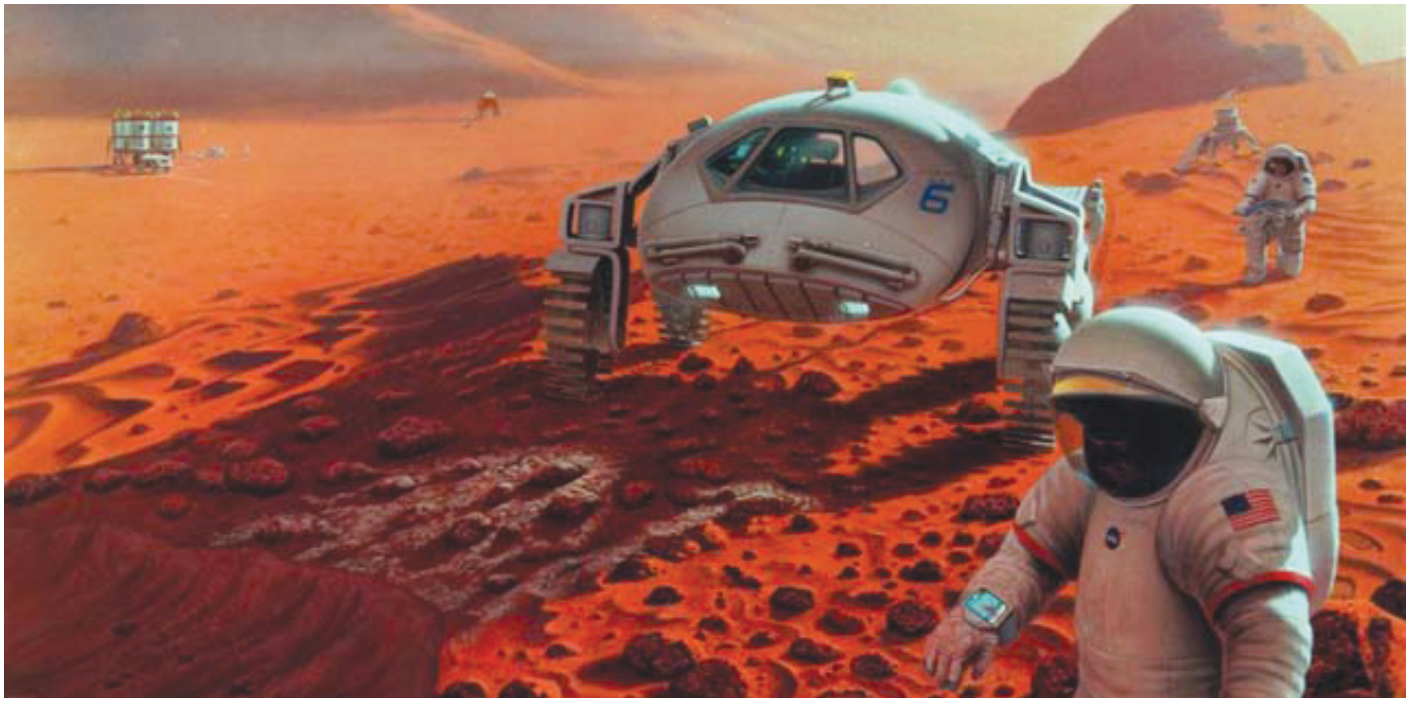
Welcome To
The Ames Exploration Encounter!

The Ames Exploration Encounter (AEE) is a unique educational program that fosters positive attitudes about science, math and technology so that students will aspire future careers as astronauts, aerospace engineers, and research scientists.

Located in a renovated supersonic wind tunnel building at NASA Ames in Mountain View, California; this classroom makes math and science curriculum come alive. Students experience science in action and realize its connection to their lives!

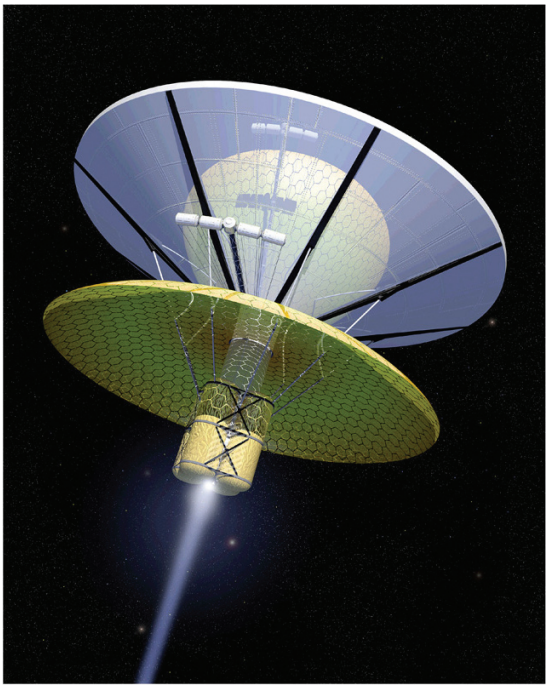


Teachers attend a free workshop and are provided teaching materials that are aligned with the National and State Standards. The AEE gives students a chance to apply many of the skills addressed in the California Department of Education Content Standards for math and science for fourth through sixth grade. In addition to Science Standards, the AEE incorporates English Language Development (ELD) standards and provides English Learners a contextualized, interactive opportunity for academic language development.

The AEE provides a classroom where student learning is enhanced through hands-on activities, cooperative learning, active discussion, and technology. Teaching is done by a diverse group of highly trained professionals who volunteer as role models for our growing population of underrepresented minority students. Our philosophy is to inspire positive attitudes about science and math while making learning fun!

About The Ames Exploration Encounter

The Ames Exploration Encounter is designed to provide an inspirational learning experience for all students. The AEE gives students a chance to apply many of the skills addressed in the California Department of Education Content Standards for math and science for fourth through sixth grade. In addition to Science Standards, the AEE incorporates English Language Development (ELD) standards and provides English Learners a contextualized, interactive opportunity for academic language development. There are four hands-on stations at the AEE



- **Space Science**
  Students experience some of the basics of physics in an interactive and fun hands-on way.

- **Aeronautics**
  Students will learn the principles of flight and wind tunnels, and use computers to design airplanes.

- **Space Station**
  Students will work on a simulated space mission performing a variety of tasks and experiments.

- **Mission Control / Earth Science**
  Students work with scientific information gathered from space missions and high altitude flights to better understand our planet

Prior to your visit you will receive a crew sheet to fill out. Please divide your class into four crews. Each crew should reflect the diversity of your classroom (gender, ELL's, Special Education, GATE.) If your class has 27 or fewer students please make a crew sheet with four crews and one with three crews.

To enrich your experience of the AEE, it is strongly advised that you attend a Teacher Training Workshop. The workshop is conducted by an experienced classroom teacher who will share ideas and resources with you.

The activities in this Teacher Resource and Classroom Activities Guide have been developed by NASA and can be duplicated. The activities are aligned with State and National Teaching Standards in the areas of Math, Science, and Technology. Your students will benefit greatly if the lessons are incorporated into your teaching prior to their visit to the AEE.

Frequently Asked Questions

1. **Is it okay to bring cameras?**
   Yes, both cameras and video camcorders are welcome.

2. **Are food and/or beverages allowed?**
   There are no vending machines available to purchase snacks. Teachers are encouraged to bring light snacks for their class, or students may bring snacks to share with one another.

3. **Can students bring backpacks?**
   Yes, we have cubbies available to place their items in.

4. **Can we have lunch at the Ames Exploration Encounter?**
   Picnic tables are available near the Visitors Center. There are no indoor lunch facilities available.

5. **What happens if we are late to the AEE, can we make up time?**
   Unfortunately not. Morning Classes end no later then 12:00PM and the afternoon session ends at 4:00PM.

6. **Can students younger then 4th grade or older then 6th grade attend?**
   No, the program is designed especially for 4th through 6th grade students. For safety reasons infants and toddlers are not allowed.

7. **Can teachers do their lesson plans during their classes visit?**
   No, teachers are an important part of the learning and are expected to participate in the trip.

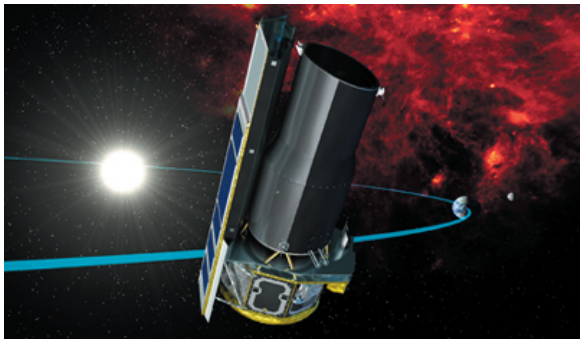
8. **Can cell phones be used in the AEE?**
   You may or may not have reception in the building, if you do please use discretion while using phones.

9. **Can students or chaperones leave early?**
   No, due to security restrictions they will need to stay for the duration.

10. **Will we be able to attend the Visitor Center and Gift Shop?**
    Yes, if you have time before or after your visit. Normal operating hours of the Visitors Center: 8:00AM - 4: 30PM, Gift Shop hours: 10:00AM - 4:00PM

11. **What is the role of chaperones?**
    The chaperones are an important part of student learning and should be able to understand and explain basic concepts to students.

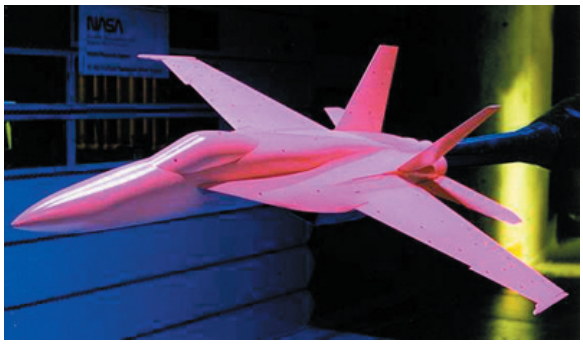
Exploration Encounter Stations



Space Science

In the Space Science area, the students participate in three physical activities that demonstrate physics concepts that are important to successful space travel.

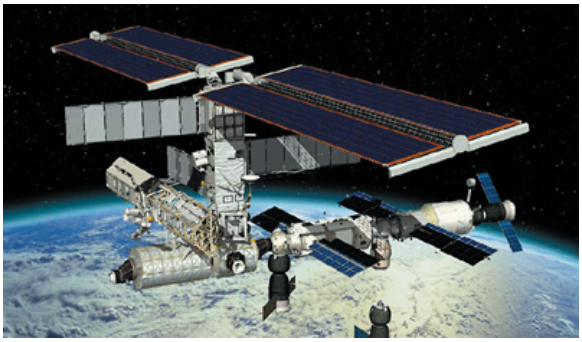
- **Orbital Chair** - Shows the importance of orbital mechanics.
  If you were sending a space probe to Jupiter - where would you aim it?
  As the orbital chair rotates, the students who are sitting on it must throw a ball back and forth.
- **Momentum Machine** - Shows the Conservation of Angular Momentum.
  Why do ice skaters spin faster when they bring their arms close to their body?
  As they turn, the students lean in and out to change their speed.
- **Gyro Chair** - Demonstrates how gyroscopes work.
  How are gyroscopes used to orient satellites and space probes?
  Students use a spinning gyroscope to rotate themselves in the Gyro chair.



Aeronautics

In the Aeronautics area, the students learn how NASA scientists and engineers design aircraft.

- **Forces on an Airplane** - Students learn about the four forces on an airplane:
  Gravity, Lift, Thrust and Drag
- **Wind Tunnels** - Students learn how wind tunnels work, view a retired wind tunnel and use a tabletop wind tunnel.
- **Computers** - Students use computers to predict airflow and to design their own aircraft.



Space Station

In the Space Station area, the students are members of a crew aboard a simulated space station.

Each member of the space station crew has an assignment or experiment to perform similar to those conducted on board actual spacecraft.

By working together, the students are able to have a successful mission.

Mission Control

In the Mission Control area, the students collect scientific data from space missions and from high altitude flights.

- **Mission Control** - Students support the space station mission and use information from the space station to study the Earth.
- **Remote Sensing** - Students use pictures taken from high altitude flights to study the Earth and its environment.
- **Lunar Geology** - Student's use an Apollo glove box to study simulated moon rocks.

Vocabulary

The definitions provided are aimed at 4th-6th grade students who will attend the Ames Exploration Encounter. Therefore, some definitions may have been simplified so they relate more directly to the experience.

Space Science

Gyroscope - A spinning wheel that tends to maintain its direction in space.

Momentum - The tendency of a moving object to keep moving.

Moon - A natural object orbiting a planet.

Orbit - The path of a satellite around a planet or of a planet around its star.

Planet - A large, natural object that orbits a star.

Revolve - To move in a circular orbit; such as the Earth going around the sun.

Rotate - To turn around an axis or center point; which causes day and night on the Earth.

Satellite - A natural or man-made object which orbits a larger object; such as the moon orbiting the Earth.

Solar system - A system of a stars and all the objects that orbit it; Our solar system includes the sun, 9 planets, their moons, asteroids, and comets.

Space - The area above a planet's atmosphere.

Space probe - An unmanned spacecraft that explores the solar system and sends data back to Earth.

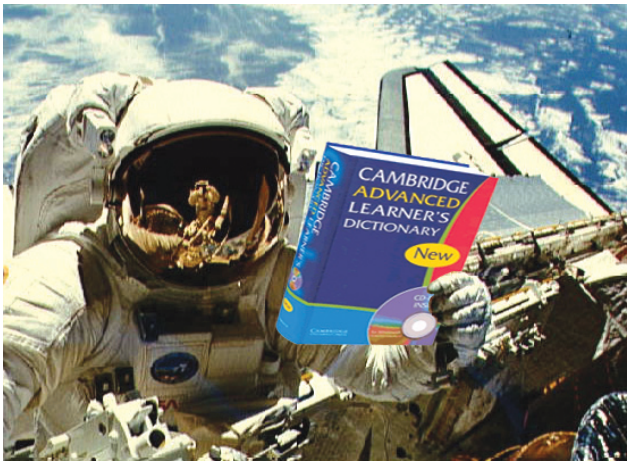
Stability - Resistance of an object to a change in its position.

Star - A point of light in the night sky. In the daytime only one star is visible - the sun - which, like the other stars, is a ball of gas which produces its own heat and light.

Trajectory -The curve of the path of a spacecraft in flight.

Vacuum - A space containing no matter or air.

Velocity - The speed and direction of an object.



Aeronautics

Ailerons -The parts of the wing that control the airplane's roll (its left and right tilting).

Air pressure - The force of air spread over a surface; it can be caused by the weight of the atmosphere above or by moving through the atmosphere.

Airfoil - The shape of a wing's cross-section (a slice across the wing), designed to create as much lift and as little drag as possible.

Atmosphere - The gases surrounding a planet.

Drag - The force due to air that slows down the plane as it moves forward.

Elevator - The part on the tail that controls the plane's pitch (its up and down tilting).

Force - A push or pull on an object.

Fuselage - The part of a plane which holds people and cargo and to which the wings and tail are attached.

Gravity - The force of attraction between two objects (such as the force between you and the Earth).

Lift - The force that keeps an airplane up due to the flow of air over and under the wings.

Mach - A number that compares an airplane's speed to the speed of sound 750 mph. (At Mach 2, a plane goes twice the speed of sound).

Rudder - The parts of the tail surfaces that control a plane's yaw (its left and right turning).

Supersonic - A term that indicates motion faster than the speed of sound (more than Mach 1 but less than Mach 5).

Thrust - The force of the engine, which pushes a plane forward.

Wind tunnel - A long tube or tunnel in which an airplane is held still and air is blown over it. They are used to test airplane designs by simulating flight while instruments measure lift and drag.

Space Station

Astronaut - A person who trains to fly into space.

Cosmonaut - A Russian astronaut.

Dehydrate - To dry out.

Engineer - A person trained to design, construct, and operate mechanical or electrical instruments.

Environment - The air, water, minerals, organisms and all other interconnected things in a particular place.

Freefall - A condition where an object is falling without being stopped or slowed down, if its surroundings are also falling at the same rate, the object appears to float. This occurs on a spacecraft in orbit.

Observation - The act of gathering information by watching or by remote sensing.

Payload - All the cargo, including scientific equipment, carried in a spacecraft.

Pressurize - To raise the atmospheric pressure to the desired level in a closed area, such as a space suit.

Pulse - A heartbeat.

Ration - A fixed amount of food or water when the supply is limited.

Recycle - To treat material so that it can be used again.

Solar panel - A device that changes sunlight into electricity; made of solar cells.

Space shuttle - A reusable, crewed spacecraft used to place satellites in earth orbit and to conduct experiments.

Space station - A manned structure that orbits the Earth and is used for a variety of purposes, especially research.

Weightless - Being without weight, as an object in freefall or orbit.

Mission Control

Altitude - The height above sea level.

Communications - A means of sending and receiving messages and information.

Debriefing - The discussion of the results of a mission.

Geology - The study of the earth, including rocks and minerals.

Infrared - A type of light that can't be seen by humans but that instruments can use to measure the heat differences between objects.

Latitude - The distance north and south from the Equator, expressed in degrees.

Longitude - The distance east and west from Greenwich, England, expressed in degrees.

Lunar - A term referring to the moon.

Mission - A particular task that a person or group is to perform.

Remote - Far away.

Scientist - An expert in science.

Sensing - Seeing, feeling, tasting, smelling or hearing; The ways people, animals, and instruments perceive the things around them.

Specialist - A person who concentrates on one subject or area of interest.

Volcanic - A term meaning formed by a volcano.

Student Crew Assignments

Space Station

Communications Specialist: Communicates via video camera with mission control. Multi-tasking skills needed, good reading and oral communication skills needed.

Engineering Specialist: Determines energy and life support systems on board. Should be able to do simple multiplication. Reading at 5/6 grade level.

Earth Observation Specialist: Observes coordinates of volcano and determines its impact. Reading level is at a 5/6-grade level. Will also do some addition and division.

Medical Specialist: Active participation, students exercise and measure the effects of exercise on pulse rate. (Ideal for English Language Learners or students who require more teacher or chaperone assistance.)

Tethered Satellite Specialist: Student will measure the effects of pollution on the ozone layer. Reading level is at a 5/6-grade level. Analytical skills.

Biologist: Investigates how frog eggs and tadpoles will develop in space. Reading Level is at the 4/5-grade level. Some simple division.

Mission Control

Communications Specialist: Communicates via video camera with Space station. Multi-tasking skills needed, good reading and oral communication skills needed.

Global Positioning System Specialists: Students will read maps and use a GPS to locate longitude and latitude. Ability to understand and follow complex instructions.

Remote Sensing Specialist: Identifies landmarks from photos taken via satellite. Reading at the 5/6-grade level. Good observation skills.

Geologist: Using a glove box, these researchers will examine simulated moon rocks and identify their characteristics. (Ideal for English Language Learners, some reading and ability to do division.)

Earth Observation Specialist: Observes coordinates of volcano and determines its impact. Reading level is at a 5/6-grade level. Will also do some addition and division.

Student Crew List

Teacher _____ School _____ Grade _____ Date _____

Space Station	Student Crew 1	Student Crew 2	Student Crew 3	Student Crew 4
Communicat. Specialist (1 with Good reading/ organizational skills)				
Engineering Specialist (1 or 2 with good math skills)				
Earth Observation Specialist (1 or 2 students)				
Medical Specialist (2 students, ELLs)				
Tethered Satellite Specialist (1 student only)				
Life Science Specialist (1 student only)				

Mission Control	Student Crew 1	Student Crew 2	Student Crew 3	Student Crew 4
Communicat. Specialist (1 with Good reading/ organizational skills)				
GPS Specialists (2 students with good math skills)				
Remote Sensing Specialists (1 to 2 students)				
Geology Specialists (2 students, ELLs)				
Earth Observation Specialist (1 student only)				

Each class will work in crews. If your class has 28-36 students, please divide students into 4 crews. Make two crew lists if your class has 27 or fewer students; one with 3 crews and one with 4. Please do not assign the same student to do the same job in Space Station as in Mission Control.

Pre-Visit Checklist

We are guided by NASA/AMES regulations and are unable to make exceptions.

One Month Before:

- [ ] Requests for visits by Foreign Nationals (i.e., anyone who is not a US citizen) may be disapproved unless submitted at least 30 days in advance of the visit start date. Visitors from designated countries require 60 days advance submission.
- [ ] FAX or email the list of all adults attending the Ames Exploration Encounter no later then two weeks before your visit. All adults over the age of sixteen will require identification. The following information is required:

  First Name, Last Name and Middle initial as it appears on Drivers License or Green Cards.
  No nicknames, as this may deny the person entrance.
- [ ] All persons must be U.S. Citizens or Permanent Residents with Identification.
- [ ] Notify us if you will be coming by bus or carpool. Your bus drivers name must be included in your list of adults and must have proper documentation.
- [ ] The AEE is wheelchair accessible; please notify us of any physical or medical limitations.
- [ ] Please let us know if you have English Language Learners as we have docents who are Bilingual.

One Week Before:

- [ ] Plan your arrival at least 15 minutes prior to the start of your scheduled field trip. Badging of adults may take up to 15 minutes or more.
- [ ] FAX your crew list form to us. Don't forget to make a three-crew sheet as well as a four-crew sheet for classes with 27 or less students. Bring 4 copies.
- [ ] Confirm your chaperone list. Although we value participation by all parents and guardians, they are a part of the learning experience and will be expected to understand and explain basic concepts to students. At least one chaperone will be required for every crew.

One Day Before:

- [ ] Remind students about appropriate expectations and clothing. (No hats allowed)
- [ ] Provide students with name tags with very large print (If you can't read it, neither can we)
- [ ] Remind students to bring a light snack.
- [ ] Please escort the students quietly up the steps since there are offices on the first and second floor.

Student Objectives

Space Science

Mass and Volume-Visit To A Tiny Planet (K-4)

To discover if an object's weight can be determined by its size.

Aeronautics

Women-Excelling In Aviation (5-8)

To use software to create a spreadsheet and graph of female pilots.

Space Station

What Should I Wear? (5-8)

To research and report on the environmental extremes of an area and how humans protect themselves from these extremes.

Mission Control

Coordinating Coordinates (5-8)

To learn to use coordinates and grids to locate features on a map.

Additional Science Activities

Traditions On Earth and In Space (5-8)

To learn how traditions shape our lives.

Contact Information

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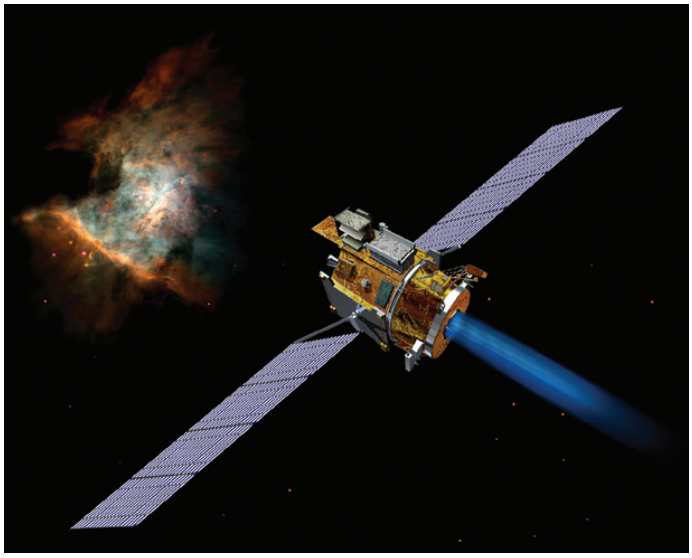
Ames Exploration Encounter Website
http://encounter.arc.nasa.gov

The Ames Exploration Encounter Staff and Docents welcome you and thank you for your visit!

Additional Resources

Educator Resource Center
650-604-3574

Ames Exploration Center
650-604-6274

Moffett Historical Society
650-604-6274

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