GLOSSARY

DELTA-V
A scalar which takes units of speed that measures the amount of "effort" needed to carry out an orbital maneuver, (to change from one trajectory to another).

KÁRMÁN LINE
An altitude of 100 kilometres (62 mi) above the Earth's sea level, that is commonly used to define the boundary between the Earth's atmosphere and outer space.

GEOSTATIONARY ORBIT
(GEO) is a special case of geosynchronous orbit where the satellites stays at an absolutely fixed point relative to the Earth's surface at all times. This must be above the equator.

GRAVITY TURN
A spacecraft maneuver where the craft rolls over due to the rocket engines shifting slightly to direct thrust to one side. This flattens out the trajectory while increasing velocity.

IN-SITU RESOURCE UTILIZATION
The production of useful materials from the resources available at a given location. Regarding space exploration, this describes the proposed use of resources found or manufactured on other astronomical objects such as the Moon, Mars, or Asteroids to further the goals of a space mission.

LOW EARTH ORBIT
An orbit within the locus extending from the Earth's surface up to an altitude of approximately 2,000 km.

ORBITAL SPACEFLIGHT
A spaceflight in which a spacecraft is placed on a trajectory where it could remain in space for at least one orbit of the Earth.

SUB-ORBITAL SPACEFLIGHT
A spacecraft reaches space and then returns to the atmosphere after following a (primarily) ballistic trajectory.

ZERO-G
The condition of real or apparent weightlessness occurring when any gravitational forces acting on a body meet with no resistance so the body is allowed to accelerate freely.

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SYNOPSIS:

With the retirement of NASA's space shuttle fleet in 2011, the role of getting people, satellites and other instruments into space falls to private companies. It is projected that within ten years, the number of people who will have flown into space will increase by about 600 percent due to the increasing market of suborbital spaceflight and the possibility of private citizens utilizing space flight. This program explains suborbital and orbital spaceflight and the requirements necessary for vehicles to achieve these journeys. We go behind the scenes of many of the private companies involved in taking on the tasks to travel to low Earth orbit and beyond and uncover some of the technology used to accomplish these goals.

CURRICULUM UNITS:

- Chemistry
- Engineering
- Physics
- Physical Science

CAREER OPPORTUNITIES:

- Aeronautical Engineer
- Chemist
- Computer Scientist
- Electrical engineer
- Mechanical Engineer
- Physicist

PROGRAM OVERVIEW:

Orbital spaceflight occurs when a spacecraft is placed on a trajectory where it can remain in space above 100 kilometers for at least one orbit of Earth. To remain in orbit at this altitude requires an orbital speed of approximately 7.8 kilometers per second. Orbital speed is slower for orbits higher than 100 kilometers above the earth's surface, but attaining a higher orbit requires a larger thrust. Sub orbital spaceflight, however, is accomplished when a spacecraft has reached an altitude where its trajectory intersects the atmosphere or surface of the gravitating body from which it was launched so that it does not complete one orbital revolution.

Scientists cite many benefits to exploring space, including the possibility that the moon and gas giants like Jupiter contain high levels of Helium 3 that can be used to run nuclear fusion reactors at a much lower cost and without any radioactive waste compared to fission reactors. Another idea is to collect solar power more efficiently since the sun is always shining in space.

ISSUES & CRITICAL THINKING:

1) Discuss the requirements of vehicles designed for sub-orbital spaceflight, orbital spaceflight, and long distance rockets that will go to the Moon and beyond.

2) Discuss with students what economic and technological hurdles must be overcome to make space travel available to the average person.

3) Ask students to research the technology that was used in the rockets of the first U.S. mission to the moon. Discuss how technology has evolved and what we might see in the future to improve long distance space travel.

4) Judge the value of spaceflight as a tourism industry. Compare and contrast the costs and benefits of tourism on earth with the potential costs and benefits of space tourism.