A busy school year for spacecraft

During this school year, more than a dozen spacecraft will be launched, including five scheduled shuttle missions and two Russian missions to the International Space Station (ISS). In addition, the Hubble Space Telescope (HST) will be visited for scheduled maintenance; the International Space Station will be expanded; and a half-dozen satellites will be placed into Earth's orbit.

While the Earth will be the site of a lot of activity, other sites in the solar system also will see traffic. This fall, the *Ulysses* spacecraft, which was launched in 1990, will make its fourth pass over the Sun's north pole to study the space environment above and below the star. Eventually, the craft will swing around the Sun and slingshot out to Jupiter, which serves as the other end of its orbit. Speaking of Jupiter, the plucky and long-lasting *Galileo* spacecraft will be repositioned to fly past the volcanic moon Io in January 2002, and then again in December, completing its 32nd and 33rd flybys since its arrival at Jupiter nearly six years ago.

Closer in, the *2001 Mars Odyssey* spacecraft will be arriving at Mars on approximately the 24th of October. Once in a stable orbit, the *2001 Mars Odyssey* will begin a 29-month (one Martian year) mission to study the radiation environment of Mars, analyze the planet's climate and geologic history, and search for liquid water. Knowledge gained from this mission will directly affect the 2003–2004 mission, which will send a pair of rovers to explore Mars.

This December, the Moon and Sun meet in a solar eclipse similar to one that crossed the United States in 1994. This is an annular solar eclipse, a partial eclipse that at any other time would be a total eclipse. During this eclipse, the Moon does not entirely cover the disk of the Sun; this creates an *annulus*, or ring or fire, around the Moon. While the *centerline*—the path of the Moon's shadow across the Earth's surface during an eclipse—runs across Central America between San Jose, Costa Rica and Managua, Nicaragua, the annulus may still be viewed from the southern and southwestern portions of the United States. Two weeks later, the full Moon passes through the outer and fainter part of the Earth's shadow called the *penumbra*. This penumbral lunar eclipse, on December 30th, will be visible across the entire United States. Penumbral eclipses are typically not very noticeable; however, the brightly shining planet Jupiter will illuminate this eclipse.

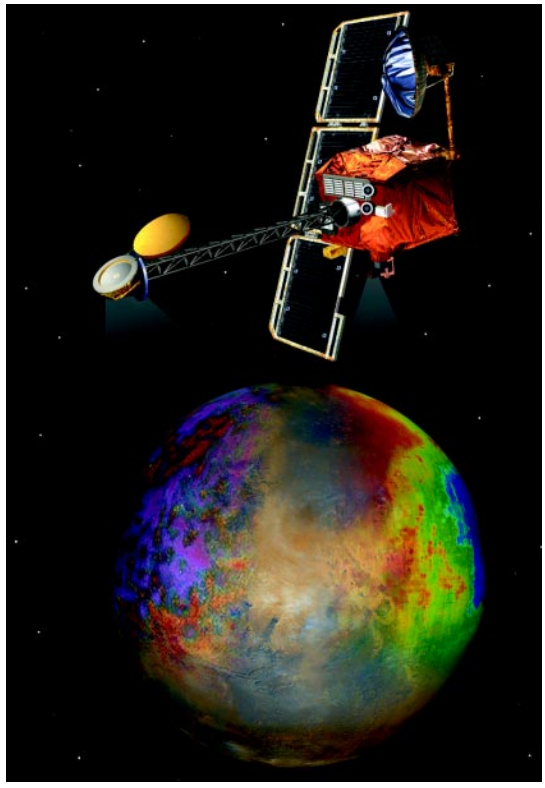

IMAGE COURTESY OF NASA/JPL

Will the 2001 Mars Odyssey *find liquid water or evidence of past life on the Red Planet?*

The school year comes to a close with another pair of eclipses. On May 26, a second penumbral lunar eclipse occurs that, unfortunately, will not be visible from the United States. A partial solar eclipse will follow it on June 10th and will be visible from the midwest United States and westward toward Hawaii.

Visible planets

• Venus, Jupiter, and Saturn will be visible during the morning hours.
• Mars and Mercury will be visible during the evening hours.

Moon phases

	Aug	Sept	Oct
Full Moon	8/04	9/02	10/02
Last quarter	8/12	9/10	10/10
New Moon	8/19	9/17	10/16
First quarter	8/25	9/24	10/24

Internet resources

STS-105 Launch: *Endeavour*: *science.ksc.nasa.gov/shuttle/missions/sts-105/mission-sts-105.html*
ISS 7A.1: *spaceflight.nasa.gov/station/assembly/flights/2001/7a1.html*
***Galileo*:** *www.jpl.nasa.gov/galileo*
Jason/TIMED (to study ocean circulation): *jason@www-projet.cst.cnes.fr:8060*
Perseid Meteor Shower: *comets.amsmeteors.org/meteors/showers/perseids.html*
ISS 4R: *spaceflight.nasa.gov/station/assembly/flights/01/4r.html*
***Ulysses*:** *ulysses.jpl.nasa.gov*
***PICOSAT/Starshine 3*:** *www-pao.ksc.nasa.gov/kscpao/release/2001/49-01.htm*
***Starshine*:** *azinet.com/starshine*
***EOS Aqua*:** *eos-pm.gsfc.nasa.gov*
***2001 Mars Odyssey*:** *mars.jpl.nasa.gov/odyssey*
STS-108 launch, *Endeavour*: *www.ksc.nasa.gov/shuttle/missions/sts-108/mission-sts-108.html*
ISS Utilization Flight 1: *spaceflight.nasa.gov/station/assembly/flights/2001/uf1.html*
Geminid meteor shower: *comets.amsmeteors.org/meteors/showers/geminids.html*
Annular solar eclipse: *Sunearth.gsfc.nasa.gov/eclipse/SEplot/SE2001Dec14A.gif*
Lunar eclipse: *Sunearth.gsfc.nasa.gov/eclipse/LEplot/LE2001Dec30N.gif*
Quadrantids meteor shower: *comets.amsmeteors.org/meteors/showers/quadrantids.html*
Stephen Hawking's birthday: *www.psyclops.com/hawking/bio*
STS-109 launch, *Columbia*: *www.ksc.nasa.gov/shuttle/missions/sts-109/mission-sts-109.html*
Launch of *Coriolis*: *www.spectrumastro.com/ProgramsProducts/Coriolis.asp*
Galaxy Evolution Explorer (GALEX): *www.srl.caltech.edu/galex*
35th anniversary of *Apollo 1* Fire: *www.ksc.nasa.gov/history/apollo/apollo-1/apollo-1.html*
Shuttle *Challenger* disaster: *www.hq.nasa.gov/office/pao/History/transcript.html*
STS-110 launch, *Atlantis*: *science.ksc.nasa.gov/shuttle/missions/sts-110/mission-sts-110.html*
ISS Assembly Flight 8A: *spaceflight.nasa.gov/station/assembly/flights/2002/8a.html*
STS-111 launch, *Endeavour*: *science.ksc.nasa.gov/shuttle/missions/sts-111/mission-sts-111.html*
ISS Utilization Flight (UF-2): *spaceflight.nasa.gov/station/assembly/flights/2002/uf2.html*
STS-107 launch, *Columbia*: *www.ksc.nasa.gov/shuttle/missions/sts-107/mission-sts-107.html*
Spacehab: *www.spacehab.com*
Lunar eclipse: *Sunearth.gsfc.nasa.gov/eclipse/LEplot/LE2002May26N.gif*

Bob Riddle *is on staff at the Challenger Center for Space Science Education in Kansas City, Missouri. You can email him at* bridddle@challenger.org *or visit his website at* currentsky.com.

The school year in space: 2001–2002

September

1 Moon at apogee: 406,300 km
10 Saturn very close to Moon
12 Jupiter close to moon
15 Venus near Moon
16 Moon at perigee: 358,100 km
18 Mercury at greatest elongation
19 *Earth Observing System Aqua* launch
21 Autumnal equinox
25 Mars close to Moon
29 Moon at apogee: 405,800 km

October

5 Venus at perihelion
7 Saturn close to Moon
10 Jupiter near Moon
12 Mars at perihelion
13 *Ulysses* spacecraft reaches maximum northern latitude (80.2∞)
14 Mercury at inferior conjunction
Moon at perigee: 361,900 km
15 Venus near Moon
23 Mars very close to Moon

Odyssey 2001 spacecraft arrives at Mars
26 Moon at apogee: 404,900 km
29 Mercury at greatest elongation

November

3 Saturn close to Moon
6 Jupiter close to Moon
11 Moon at perigee: 367,300 km
21 Mars near Moon
22 First quarter Moon
23 Moon at apogee: 404,400 km
29 STS-108 launch, *Endeavour*

December

1 Saturn very close to Moon
3 Jupiter near Moon
Saturn at opposition
4 Mercury at superior conjunction
6 Moon at perigee: 370,100 km
10 *Ulysses* ends fourth solar passage
13 Geminids meteor shower
14 Annular solar eclipse
Moon occults Venus
20 Mars near Moon
21 Moon at apogee: 404,600 km
Winter solstice
28 Saturn very close to Moon
30 Penumbral lunar eclipse
Jupiter near Moon
Ulysses ends mission

January

1 Jupiter at opposition
2 Moon at perigee: 365,400 km
3 Earth at perihelion (0.983 AU From Sun)
Quadrantid meteor shower peak
8 Stephen Hawkingís 60th birthday
12 Mercury at greatest elongation
14 Venus at superior conjunction
15 STS-109 launch, *Columbia*
17 *Galileo*, Io 33 Flyby
Coriolis launch
18 Moon at apogee: 405,500 km
19 *Galaxy Evolution Explorer* (GALEX) launch
24 Saturn very close to Moon
25 Venus at aphelion
26 Jupiter close to Moon
27 Mercury at inferior conjunction
35th Anniversary (1967) *Apollo 1* Fire
28 Anniversary of *Challenger* disaster
Neptune-Sun conjunction
30 Moon at perigee: 360,000 km

February

14 Uranus-Sun conjunction
Moon at apogee: 406,400 km
21 Saturn very close to Moon
Mercury at greatest elongation
23 Jupiter close to Moon
27 Moon at perigee: 356,900 km
28 STS-110 launch, *Atlantis*

March

12 Mercury near Moon
14 Moon at apogee: 406,700 km
18 Mars near Moon
20 Saturn very close to Moon
March equinox
22 Jupiter near Moon
28 Moon at perigee: 357,000 km

April

4 Last quarter Moon
7 Mercury at superior conjunction
10 Moon at apogee: 406,400 km
14 Venus near Moon
15 Mars near Moon
16 Saturn very close to Moon
18 Jupiter near Moon
STS-111 launch, *Endeavour*
25 Moon at perigee: 360,100 km

May

4 Mercury at greatest elongation
7 Moon at apogee: 405,500 km
14 Saturn, Mars, and Venus near Moon
16 Jupiter near Moon
17 Venus at perihelion
23 Moon at perigee: 365,000 km
STS-107 launch, *Columbia*, Spacehab
26 Penumbral lunar eclipse
27 Mercury at inferior conjunction