The New Year in Space

NASA looks ahead to the largest number of science missions in two decades

From the launch of a long-awaited, follow-up mission to Mars to explorations charting the health of planet Earth, NASA's flight schedule for 1992 boasts an assortment of projects, including several new series of missions: microgravity laboratories and payloads devoted to materials research and the life sciences; the first mission to deploy a tethered satellite in space; and a group of flights to explore Earth's atmosphere. With 11 research flights slated for lift-off, this year's schedule is the most ambitious since NASA's halcyon years of the 1960s and early '70s.

Mechanical and operational delays are sure to alter the flight schedules as the year progresses; just last month, in fact, a mission slated for December '92 was bumped to '93. Nonetheless, NASA hopes to stick reasonably close to the following calendar.

January: NASA plans to kick off its 1992 schedule next week by launching the first in a series of shuttle-borne microgravity investigations. This seven-day mission, known as International Microgravity Laboratory-I, will study the effects of weightlessness in several types of biological and materials science experiments housed in a reusable, multipurpose science workshop known as Spacelab.

An international flight crew will double as laboratory technicians. Floating into Spacelab through a tunnel from the mid-deck of the shuttle Discovery, these researchers will set up experiments designed by more than 200 scientists from 13 countries. Among their tasks: growing colonies of cultured cells within tiny incubators, monitoring the growth of crystals after placing them in a special furnace, and exposing developing oat plants to various gravitational fields. In addition, the crew members themselves will become study subjects, undergoing biomedical tests that will record eye, inner-ear and nervous-system changes associated with the low-gravity environment of the orbiting craft.

The mission is scheduled for lift-off on Jan. 22. NASA has scheduled a second international microgravity mission for late 1994 and intends to launch future missions in this series every 18 to 24 months.

February: The Ulysses spacecraft, launched in 1990, picks up a gravitational kick from Jupiter as it swings by the giant planet. The boost will enable Ulysses to leave the ecliptic plane (in which planets orbit the sun) in order to map the sun's polar regions in 1994 and 1995.

May: Carrying four telescopes, the Extreme Ultraviolet Explorer (EUVE) will head into space to record the intensity and location of celestial emissions in a rarely studied portion of the electromagnetic spectrum: wavelengths shorter than most ultraviolet light but longer than X-rays. Mapping the intensity of extreme ultraviolet radiation throughout the sky should prove particularly useful for studying stars that have evolved into smaller objects called white dwarfs. EUVE will also measure the opacity of the gaseous material between stars.

Engineers designed the EUVE so that shuttle astronauts can transform it into another orbiting research instrument when its original mission ends — about two years from now. The refurbished lab will help scientists search for neutron stars and black holes by measuring fluctuations in the brightness of intense X-ray sources.

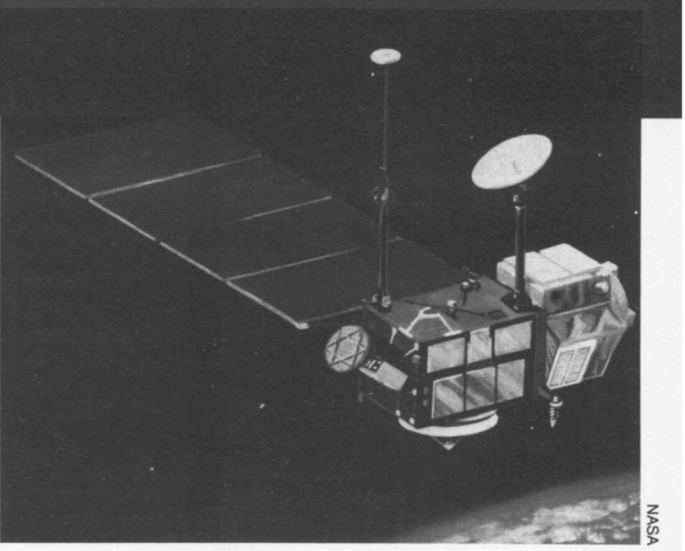
Also in May, the shuttle Atlantis will orbit the Earth for seven to 10 days, carrying the first of nine missions devoted to studying our planet's atmosphere. The missions, collectively known as the Atmospheric Laboratory for Applications and Science (ATLAS), will use the shuttle-borne Spacelab to monitor the health of Earth's atmosphere every year or two throughout an entire 11-year cycle of solar activity. Successive measurements taken during future missions will provide a highly accurate, long-term record of the depletion of Earth's stratospheric ozone layer — a fragile blanket of gas that helps protect plants and animals from the sun's ultraviolet emissions.

ATLAS-I will rely on a suite of 11 instruments — some used during previous Spacelab missions — to probe Earth's middle and upper atmosphere, measure the solar energy output and study how magnetic and electric fields in the atmosphere link Earth with the sun. During the shuttle flight, ATLAS-I's orientation in relation to Earth will change frequently, allowing spectrometers and other research tools to switch their focus to the Earth, the sun or space. One experiment, the millimeter-wave atmospheric sounder, will simultaneously record ozone concentrations, temperatures in the middle atmosphere and the amounts of trace molecules involved in the destruction and creation of ozone. In an effort to learn more about the life cycles of stars, other ATLAS-I instruments will measure ultraviolet radiation sources in the Milky Way and other galaxies.

June: The Solar Anomalous Magnetospheric Particle Explorer (SAMPEX), one of NASA's fleet of small-scale science missions, will carry four detectors to probe the energy and ionization state of streams of charged particles moving in Earth's magnetic field. During the three-year study, the detectors will measure the composition of anomalous cosmic rays, charged particles thought to originate in the gas between stars. If this origin theory is correct, the particles would have started out as neutral atoms and would have lost one electron sometime

Month	Event
January 22	International Microgravity Laboratory-I
February	Ulysses spacecraft swings by Jupiter
May	Extreme Ultraviolet Explorer; Atmospheric Laboratory for Applications and Science-I
June	Solar Anomalous Magnetospheric Particle Explorer; United States Microgravity Laboratory-I
July	Topex/Poseidon; Geotail
September	Mars Observer; Tethered Satellite System; Spacelab-J
November	United States Microgravity Payload
December	Galileo spacecraft swings by Earth a second time

By RON COWEN



NASA

Scheduled for a July launch, the Topex/Poseidon craft will use radar to study the surface of Earth's oceans.

after entering the solar system.

SAMPEX will give scientists their first opportunity to directly measure the charge associated with these particles. The Earth-orbiting craft will also measure the energy and composition of charged particles emanating from the sun, cosmic rays from distant reaches of our galaxy and high-speed electrons that plunge into our atmosphere — all with unprecedented sensitivity.

June also marks the scheduled launch of the first U.S. Microgravity Laboratory, a continuing project designed to boost U.S. efforts at processing materials in the low-gravity environment of the space shuttle. The first mission will last 13 days. Future missions in this series will fly about every 2½ years in order for researchers to build upon the results of previous missions. NASA expects these studies to help lay the foundation for technologies needed to develop the planned space station.

July: NASA focuses solely on planet Earth this month, with one mission devoted to examining the oceans and another dedicated to probing the outer reaches of Earth's magnetic field.

An Ariane-IV rocket will lift a U.S.-French satellite into space from the Guyana Space Center in Kourou, French Guyana. Called Topex/Poseidon, the Earth-orbiting craft will periodically aim radar beams at specific parts of the sea surface during its three- to five-year mission. An on-board altimeter will measure the distance between the ocean and the satellite by recording the intensity of radio waves bouncing back from the sea surface. Combining these data with precision-tracking of the satellite's position in relation to Earth's center, researchers will chart sea-level changes as small as 13 centimeters.

Such measurements can reveal the magnitude of eddies and currents that not only create hills and valleys in the ocean surface, but also shape global ocean dynamics. To detect periodic fluctuations in ocean height, Topex/Poseidon will take radar measurements of the same patches of the sea every 10 days.

Also in July, a Delta-II rocket will launch Geotail, a Japanese-built spacecraft designed to probe Earth's magnetic field. During its first year of operation, the craft will explore distant segments, including the elongated, comet-shaped field known as the magnetotail. To study the magnetotail's farthest reaches, Geotail will periodically swing by the moon to get the gravitational kick it needs to maintain a highly elliptical orbit, which will take the craft about 1.6 million kilometers away from Earth. Later in its three-year mission, Geotail will reduce its orbit by 80 percent to make magnetic measurements closer to home. Eight particle detectors — built in a collaboration between NASA and Japan's Institute for Space and Astronautical Science — will measure the energies of charged particles throughout the mission.

September: A trio of intriguing missions should keep NASA personnel busy. The clear standout: the launch of Mars Observer, the first U.S. mission to the red planet since the two Viking craft reached there in 1976. A Titan-III rocket will help send the craft on its 11-month journey. As the Mars Observer nears its destination in September 1993, on-board thrusters will move the instrument into a highly elliptical orbit around the planet for some 20 days. Further firings of the thrusters will then manipulate the craft into a nearly circular, 400-kilometer polar orbit around Mars.

From this vantage point, it will begin a two-year mapping of the entire planet with several visible-light cameras and infrared and radio-wave detectors. The craft will relay data to Earth daily; researchers hope to use the information to construct a detailed portrait of Martian geology, climate and weather.

In another landmark event slated for September, a space shuttle will reel out a tiny satellite connected by only a thin umbilical cord — a 20-meter tether. For 36 hours, the spherical satellite, just 1.6 meters in diameter, will float above the shuttle, guided by its own miniature supply of nitrogen propellant. Instruments housed inside the craft will enable Earth-based researchers to analyze forces (such as friction) acting on the satellite, as well as the electromagnetic interactions among shuttle, the tether and the surrounding space plasma. The Tethered Satellite System, a joint undertaking of NASA and the Italian Space Agency, will likely pave the way for other experiments-on-a-leash.

Also in September, a space shuttle will ferry a special seven-day cargo: Spacelab-J, a joint project of NASA and Japan's National Space Development Agency, involving more than 30 investigations in life sciences and materials processing.

November: NASA inaugurates the first of what it hopes will be yearly shuttle flights to investigate the direct effects of the space environment on a variety of materials, such as liquid helium near the temperature at which it becomes a superfluid. The cargo, mounted on carriers open to space rather than housed in a pressurized laboratory such as Spacelab, will be limited to experiments that crew members can conduct via remote control. Each suite of experiments — formally known as the United States Microgravity Payload — includes a sensitive measuring system that will detect small jolts to the microgravity system.

December: The Galileo spacecraft swings past Earth for its second and final gravitational sendoff toward a 1995 rendezvous with Jupiter. If the craft's main antenna — a key communications link with Earth — remains jammed, Galileo may be restricted to relaying only a fraction of the data it acquires during its exploration of the giant planet.

Even so, NASA hopes to beam down high-resolution images this spring of the asteroid Gaspra, which Galileo photographed last Oct. 29. These images, now stored on an on-board tape recorder, are several times sharper than the Gaspra photos retrieved last fall (SN: 11/23/91, p.326). □