Scientists join astronauts on space research frontiers

by Marsha Freeman

For the first time in the history of the U.S. space program, scientists chosen by their peers to do experiments in space have been given the opportunity to work in Earth orbit without having to interrupt their scientific research to be trained as astronauts. For nine days, two scientists are joining a crew of four astronauts to perform more than 70 scientific experiments that cannot be done in the gravity environment of Earth.

Skylab, a nearly $1 billion facility built by the European Space Agency (ESA), is undergoing its first verification tests in space on the ninth Shuttle mission. The nine-day STS-9 mission, launched on Nov. 28, will relay results to scientists on the ground from experiments in the life sciences, astronomy, solar plasma physics, materials processing, and Earth and atmospheric physics.

Never before has such a variety of experiments been performed on one flight. Never before have scientists, untrained as astronauts, come straight out of their Earth laboratories to accompany their experiments into space.

The Space Shuttle provides a launch environment that is so benign that healthy people who are not necessarily in top-flight physical condition can make the journey into space. Spacelab provides them with a shirt-sleeve environment where frontier scientific instruments are at their disposal, for studying the Earth, the cosmos, and the effects of zero gravity.

Spacelab

This new laboratory in space is designed to be flown inside the payload bay of the Shuttle orbiter, and depends upon the orbiter for its electricity, air, water, and all consumables. In the pressurized laboratory, scientists have racks with experiments, work benches, and computers, and also a series of pallets which are uncovered, to expose experiments directly to the environment of space, so that telescopes and materials can be tested without any protective covering. The first Spacelab mission is using the pressurized lab and one pallet of instruments.

The laboratory is designed to be flown 50 times, for up to 30 days per flight. Since it comes back to Earth inside the orbiter, it can be outfitted with different scientific instruments for each flight, depending upon the kinds of experiments planned, and can be updated to take advantage of advanced instrumentation.

Spacelab represents the first non-U.S., non-Soviet foray into manned space flight, and is giving the Europeans their first experience in this field. Some of the Spacelab missions in the future will be dedicated flights where the entire laboratory will consist of European experiments. On this first flight, there are experiments from 14 nations, including the ESA countries, the United States, Japan, and Canada.

In its first two days in orbit, Spacelab has already given some of the principal investigators from the 72 separate experiments the opportunity to talk to the scientists on board as they work together to maximize the data output of the research. These scientists who have experiments in space are stationed in the Payload Control Center at NASA's Johnson Space Center in Houston to be on hand if they are needed to give directions and confer with their colleagues in space.

Solving space sickness

The first few days of the Spacelab flight are being dedicated to the study of Space Adaptation Syndrome, the motion sickness many astronauts have experienced in orbit. These life science experiments include the study of changes in the vestibular system of the ear, to determine how balance and the perception of body orientation are effected by zero gravity.

Scientists have speculated that the information relayed by the vestibular and otolith balance organs in the ear during the first day or so of zero gravity conflicts with information relayed from visual and other sensory organs. Since the Space Adaptation Syndrome usually abates after the first day in space, scientists theorize that this erroneous data is either suppressed or ignored by the brain as the body adjusts to space.

The non-astronaut scientists, Drs. Byron Lichtenberg from MIT and Ulf Merbold from the Max Planck Institute in West Germany, have been subjecting themselves to various experiments to measure their own responses to zero gravity. Dr. Lichtenberg is himself a biomedical engineer and designed some of the experiments.

One such test involves the crew member placing his head inside a rotating dome. Painted on the dome are randomly placed dots of various colors. A camera takes real-time pictures of the eye movements of the subject while the dome is rotating. One key question principal investigator Dr. Larry Young from MIT has asked the scientists to report is how

long they perceive counter-rotation after the dome has stopped moving.

Dr. Young hopes to gather data from a number of such experiments which test the ability of the subject to orient himself to moving visual stimuli to see if he has a different perception in zero gravity than in the one gravity of Earth. In other experiments, the subject himself is rotated in a chair, and asked to focus on various objects in the laboratory, to see if his response is different in space than on Earth.

Other vestibular experiments include the ability of the subject to accurately describe the location of his own limbs as his body moves, and to test reflexes that are "normal" in Earth gravity such as the movement of leg muscles.

Data collected on these Space Adaptation Syndrome experiments will help scientists determine what preventive measures can be taken to ease the body's adaptation to zero gravity, such as restraining head movements for a period of time after launch.

Other life sciences experiments will determine more long-lasting effects on the body of zero gravity. One experiment, the Effects of Prolonged Weightlessness on the Humoral Immune Response of Humans, from the University of Illinois, will examine blood samples of crew members before, during, and after the flight. Tests will analyze the total antibody content of the samples to reveal whether weightlessness is a stress factor on the immune response.

The circulating red blood cell mass of the crew will also be analyzed and could help provide an answer to the problem of temporary "spaceflight anemia" that appears near the beginning of each space mission. Understanding this change will be important for the long-duration space flights that would be necessary to go to Mars and beyond.

Other experiments will focus on plants and microbes, to see how these life forms react to space's lack of gravity. Scientists are now looking at ways of growing food in space as part of a space station program that will place personnel in orbit for long periods of time.

Understanding the Earth and the cosmos

Spacelab will give the scientific community hands-on research in all fields of space science. In the past, astronomers could send satellites out to other planets or into orbit around the Earth to make astronomical discoveries. These spacecraft were expensive and only lasted for a fairly brief period of time. By the time the data was coming in to scientists on Earth, newer technologies were already available for better science, and if the spacecraft developed problems, there was no way to fix it.

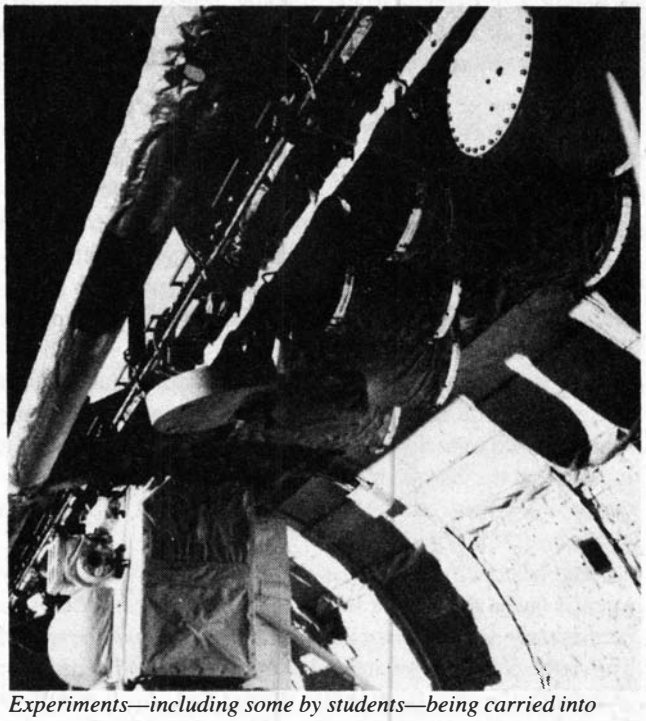
Spacelab will carry instruments into space that are on the frontier of technology. On this first mission, remarkable experiments will be done in astronomy and solar physics. Telescopes with higher sensitivity than previously possible will be taking measurements in the far ultraviolet, for example, and it is expected they will see UV emissions that are predicted just before the death of a star, but have not been observed to occur before.

Cosmic X-ray sources will be studied by an experiment from The Netherlands. The experimental device will be able to detail the energy level of X-ray sources that are observed and provide new insights into these very high-energy events in our galaxy and elsewhere.

Since the ground-breaking astronomical research carried out a decade ago aboard Skylab, one major puzzle has been the changes in the "solar constant" or amount of total energy emitted from our nearest star. Three experiments on Spacelab, from the United States, France and Belgium, will be measuring changes in this parameter, which has a significant impact on the weather, climate, ocean level and ice caps of the Earth.

Space plasma physics is the field of study of the plasma environment around our Earth and also throughout space. Charged particles thrown off from the Sun, traveling at millions of miles per hour, bombard the planets constantly. The Earth's magnetic field provides a shield against most of this plasma, except for those particles that are released near the poles and cause the auroras that we see.

On this Shuttle mission an experimental apparatus from Japan will be used to excite the plasma that makes up the upper atmosphere, or ionosphere, of the Earth to study how the auroras are created. In order to do this, the Shuttle is flying at a very low orbit of 155 miles, in the ionosphere itself. Artifical auroras, visible from Earth, will be produced as beams of electrons are shot into the ionosphere from the Spacelab pallet experiment.



NASA

Experiments—including some by students—being carried into space by the April Shuttle flight. The latest flight will carry scientists to perform experiments in biology, astronomy, and both solar and Earth physics.

Scientists expect that these beams of particles will flow along the magnetic field lines surrounding the Earth. hope to learn more about the ionosphere which stores this charged particle energy, releasing it periodically in auroral bursts. These results will bear on research needed on electron beam propagation through the ionosphere required for the study of directed energy beam weapon defense programs, though the results from these civilian experiments will be not be classified.

Materials processing experiments are in progress in Spacelab, as scientists and engineers research ways to grow large, perfect crystals on space and to create new alloys and materials.

Short-term materials processing tests on previous Shuttle flights have already demonstrated that new pharmaceuticals and products to treat disease will be new space industries in the next few years.

Many experiments will be performed to gain a better "look" at Earth. Studies will be done to determine more precisely the chemical composition and chemical reactions of the upper atmopshere. New all-weather remote sensing techniques will be tested using a microwave radar instrument which could revolutionize the Landsat-like remote-sensing satellites currently in use.

Because half the experiments aboard Spacelab during this mission are from Western Europe, the orbital inclination of the Shuttle is different than previous flights. Generally, when the Shuttle is launched from Cape Canaveral, it flies directly east across the Atlantic Ocean. When it is on this orbit, which is inclined 28 degrees to the equator, it does not pass over any region of the Earth that is further north than southern Florida, or any region that is further south than the same 28 degrees.

In order to be able to photograph Europe, the Shuttle flew northeast after launch, and is inclined 57 degrees to the equator. For the first time, the Shuttle crew will be able to photograph all of South America and virtually all of Europe, not just the mainly equitorial regions seen in past Shuttle pictures. Many nations expect that these high-resolution photographs will aid map-making efforts and will open up new regions of Earth for space investigation.

For years, space scientists have complained that the cost of Space Shuttle development has taken away money from space science experiments. With this first Spacelab flight, it is clear that the Shuttle has given space scientists the opportunity to do *in situ* research, in a laboratory that will open up whole new fields of study.

The next step, while Spacelab is providing exciting new science on its short trips into space, is to start building the permanently orbiting space science facilities that will be tended by scientists and astronauts who work in a space station for months at a time. Spacelab has proven that career scientists can foray into space and working together with their colleagues on the ground, can open up new frontiers in space science.

How Europe's food being destroyed by

by Rainer Apel

European agriculture is being threatened by the failure of the European Community's Common Agricultural Policy (CAP) to adopt an American System program of utilizing the highest level of industrial technology to expand production. A full-scale financial and political attack, on the scale of the assault on American agriculture by the world's Malthusian forces who want to cut population by cutting the food supply, is being launched against the far more vulnerable European food production system. Despite statistics that claim that Europe is self-sufficient in grain and beef production, and produces a 30 percent milk surplus, average animal protein consumption in Europe is only *50 percent* that in the United States.

In addition, CAP policy maintains the remnants of a peasant agriculture system, forcing modern productive farming to subsidize tiny farms that barely survive. If U.S. agriculture, the most productive in the world, can be destroyed by Malthusian policymakers using the hoax of overproduction, the future of Europe looks grim.

The recent statement of one West German agricultural politician to *EIR* shows how widespread the monetarist policy of cutting production in the face of financial crisis is among Western European agricultural policy makers—with the exception of the farmers themselves. When told of the extent of the world food crisis and the collapse of U.S. food-producing capacity, he stated: "I don't know whether things are as dramatic as you say. But what I see is that the Americans always wanted to feed the world, at least that is what they always told everyone, and now they can't even feed their own people. . . . All of this proves that the American system does not work, while ours in Europe does. We can feed our people, and more than that. We are, as a matter of fact, producing more than we need, and that's why we must cut back."

But another political figure described a very different, and dangerous, situation. "You speak of a food crisis in the