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SPACE SHUTTLE

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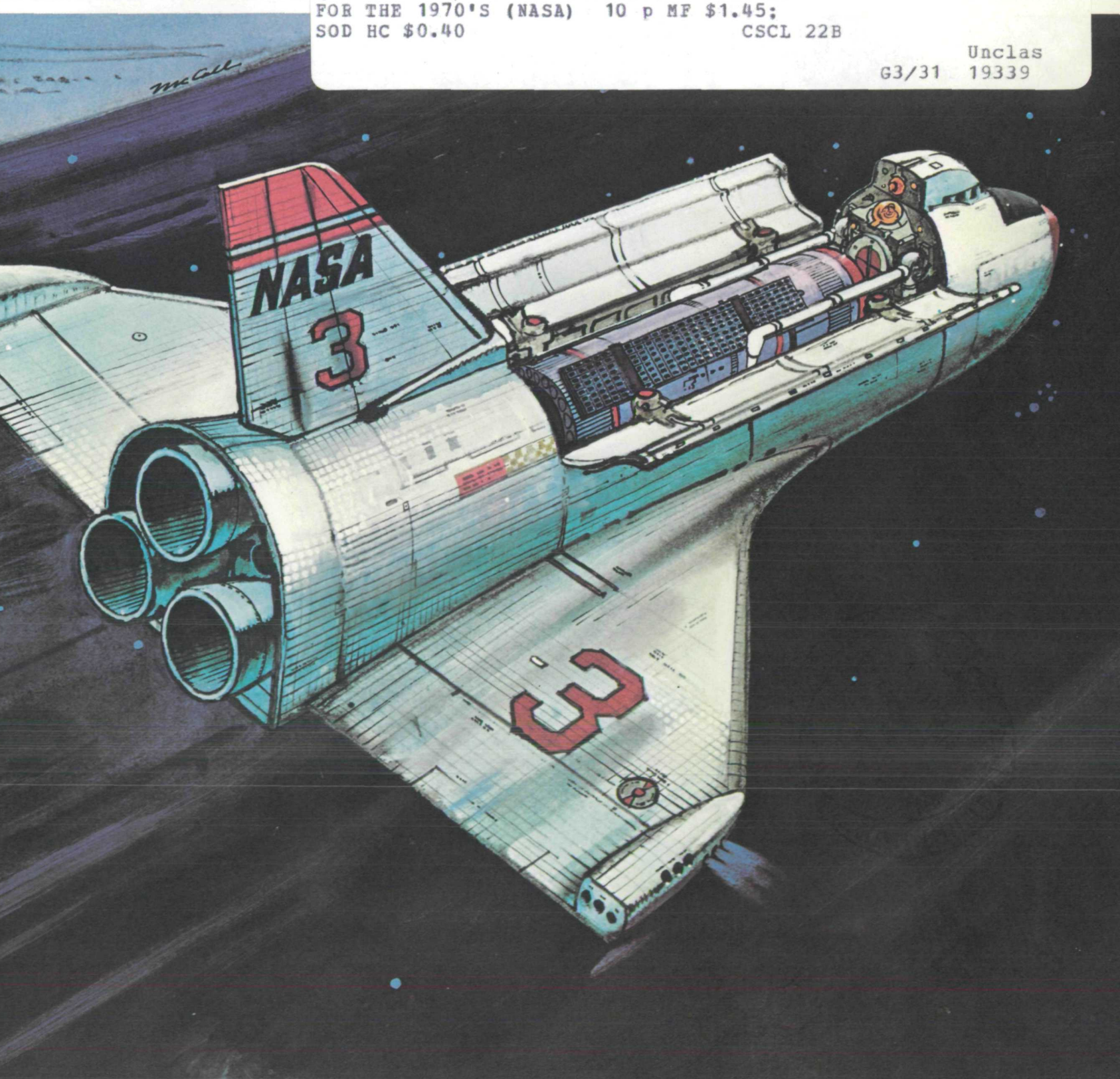

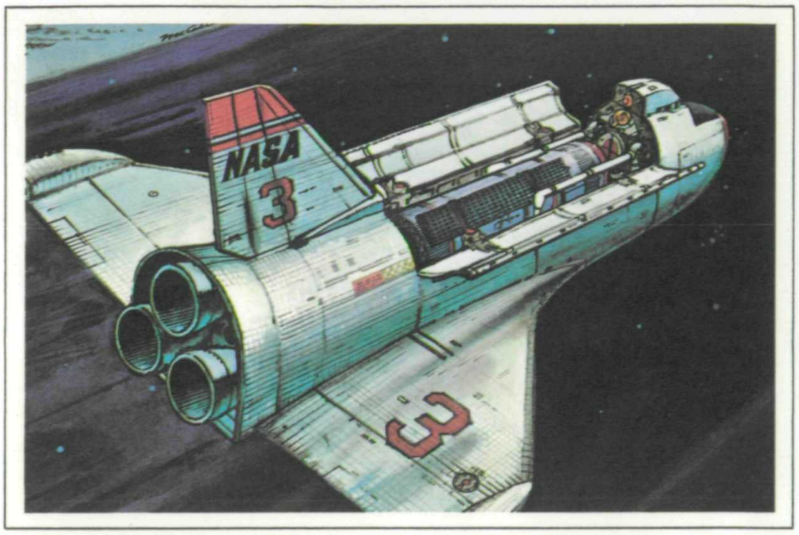
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SPACE SHUTTLE

Emphasis for the 1970's

After a decade highlighted by driving effort and dramatic achievement, America's space program is shifting emphasis. Now the goal is practical benefits for people on Earth.

The first 15 years of the Space Age have witnessed a vast outpouring of new knowledge, and development of new technology, skills and whole areas of science and engineering. These point to answers for problems that could not be solved without space flight.

Even at this early date, the practical benefits from the space program far exceed the costs. Evacuations saved thousands of lives in 1969 when weather satellites forewarned that Hurricane Camille would slam into the Gulf Coast. Communications satellites now carry half the world's international telephone, telegraph and television traffic at substantially lower prices than those of a decade ago. Thousands of new employment opportunities have been created in areas such as the $8 billion-a-year computer industry.

Soon, satellites will sense air and water pollution, send warnings of crop disease, scan the oceans for the best fishing areas and search the Earth for geologic formations associated with untapped oil and mineral reserves. The accuracy of weather forecasts will extend from the present one or two days to one or two weeks by the late 1970s. Space navigation aids will enhance flight safety in the airlanes between America and Europe. Further technological progress will lead to more jobs for Americans and increased sales of U. S. products overseas.

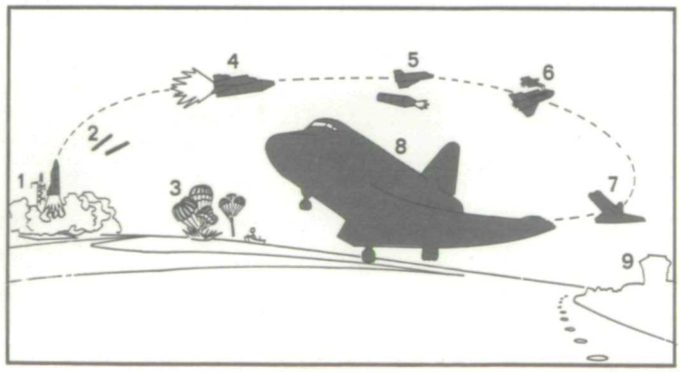
But, barriers stand in the way. Before these benefits can be achieved there must be breakthroughs in cost, time and simplicity. Space flight is still expensive. Manufacturing, testing and launching of satellites is extremely costly. Five or six years may elapse before the idea in a scientist's mind becomes the reality of a flight experiment; more time is needed to develop a satellite into a practical tool. Scientists and engineers must use remote controls. They cannot retrieve a satellite for trouble shooting if it does not operate as expected. The expensive booster for each flight to space can only be used once.

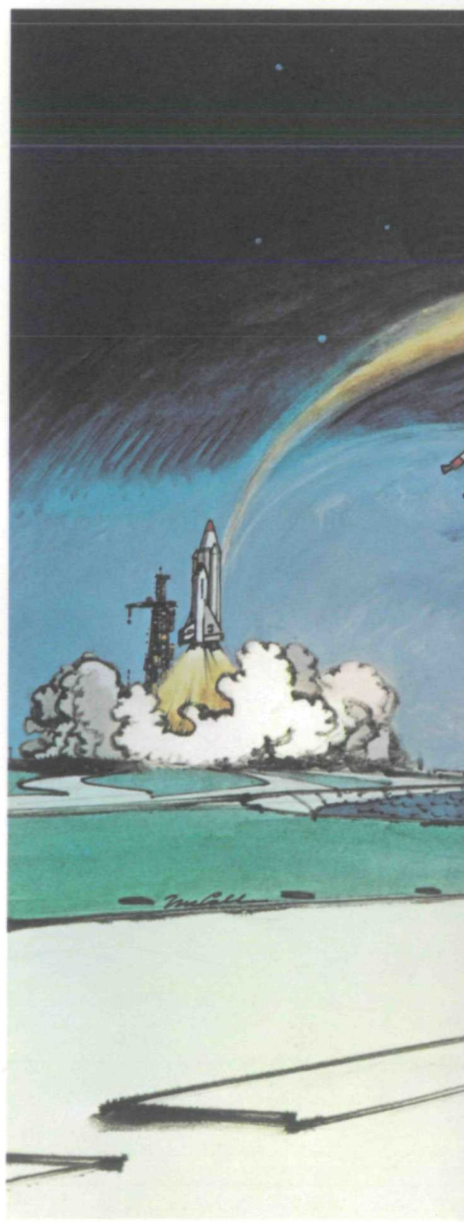
These barriers will be broken by the Space Shuttle, a revolutionary new vehicle that will combine the advantages of airplanes and spacecraft, and will fly repeatedly to space and back to Earth. It will not be expended as present space vehicles are after a single flight. Many millions of dollars will be saved by using satellite equipment over and over again, and by using low-cost standard components that can be replaced when they wear out. The years of preparation for space flight will be dramatically shortened.

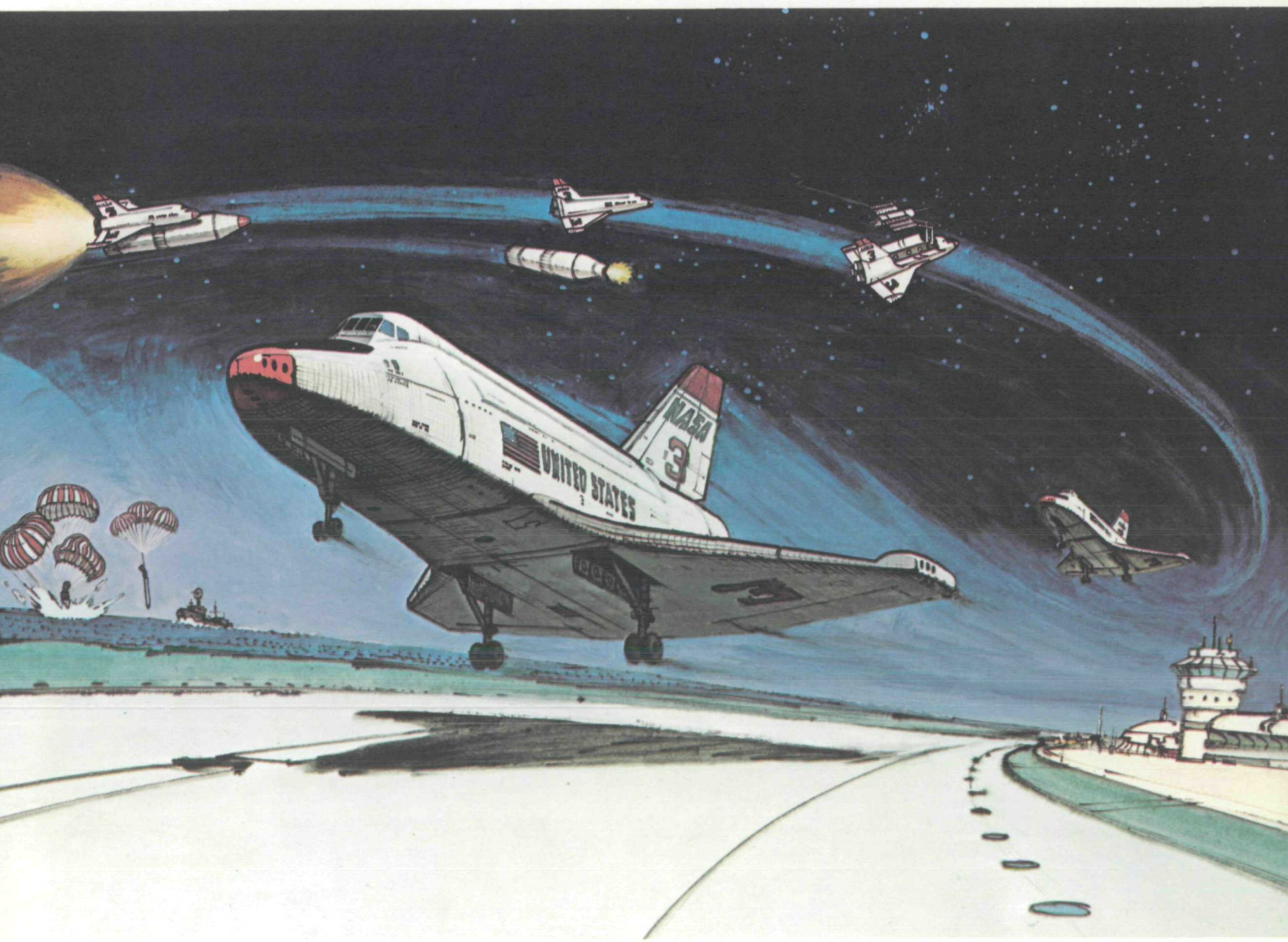
Technicians and specialists will accompany satellites into orbit, make adjustments as necessary, and bring them back to Earth for modernization and maintenance. Thus, the introduction of practical benefits will become economical, speedy and simple.

The Space Shuttle will take off vertically with a pilot and a co-pilot at the helm and two other crew members. In early operations, the Shuttle port will be at Kennedy Space Center, Florida, for east-west orbits. Later a port will be added at Vandenberg Air Force Base, California, for north-south orbits. Two solid-propellant booster rockets will supply most of the takeoff power (1). About 40 kilometers (25 miles) high, the boosters will separate (2) and descend by parachute to the ocean surface (3). There they will be recovered and returned to the launch site for re-use.

The main section of the Shuttle, called the Orbiter, will continue flying (4) on the power of its liquid-propellant engines, supplied by a large external tank. After these two sections reach orbit, the tank will separate (5) and a small rocket will cause it to re-enter and land in a remote ocean area. The Orbiter will be able to carry out space missions lasting at least seven days (6). Special materials covering its entire surface will protect the interior from the searing heat of re-entry. The Orbiter will fly horizontally like an airplane during the latter phase of descent (7) and it will land on a runway (8) near the launch site (9). As ground crews gain experience in readying it for subsequent flights, the turnaround time will be reduced to two weeks.



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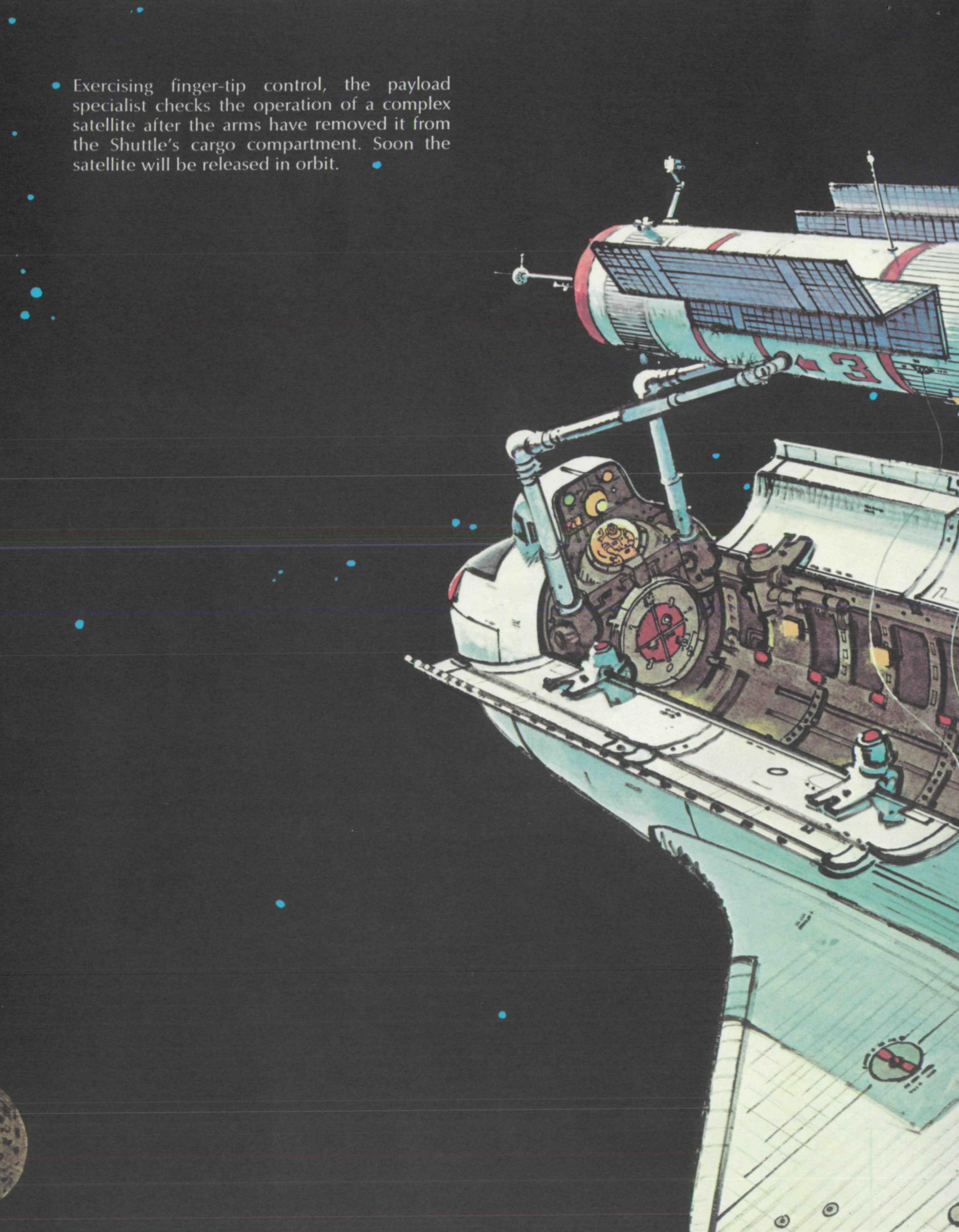
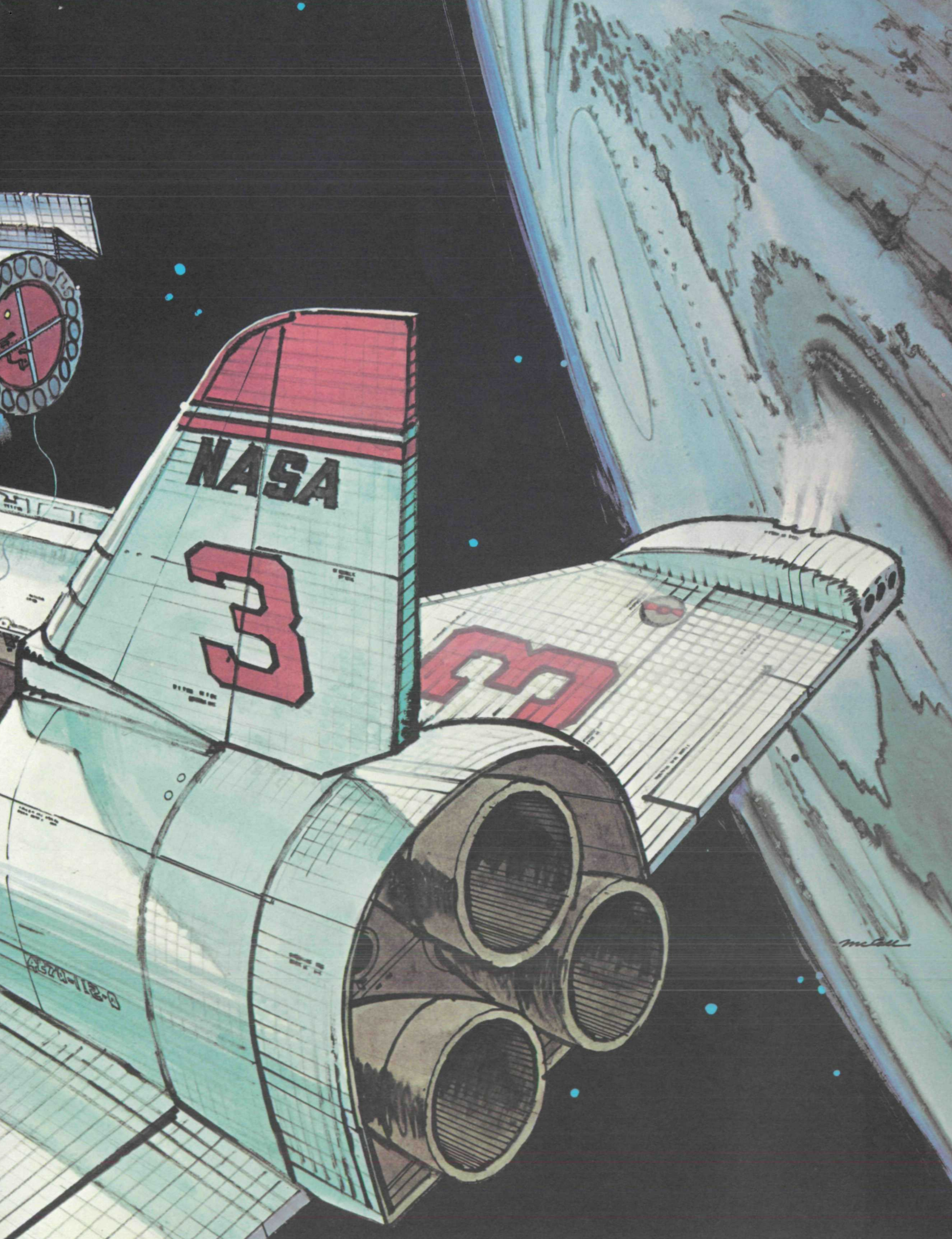
Exercising finger-tip control, the payload specialist checks the operation of a complex satellite after the arms have removed it from the Shuttle's cargo compartment. Soon the satellite will be released in orbit.

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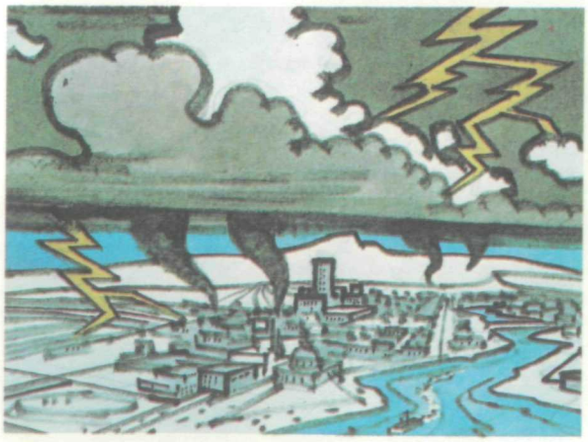
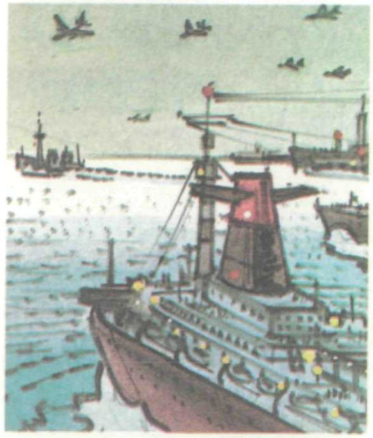
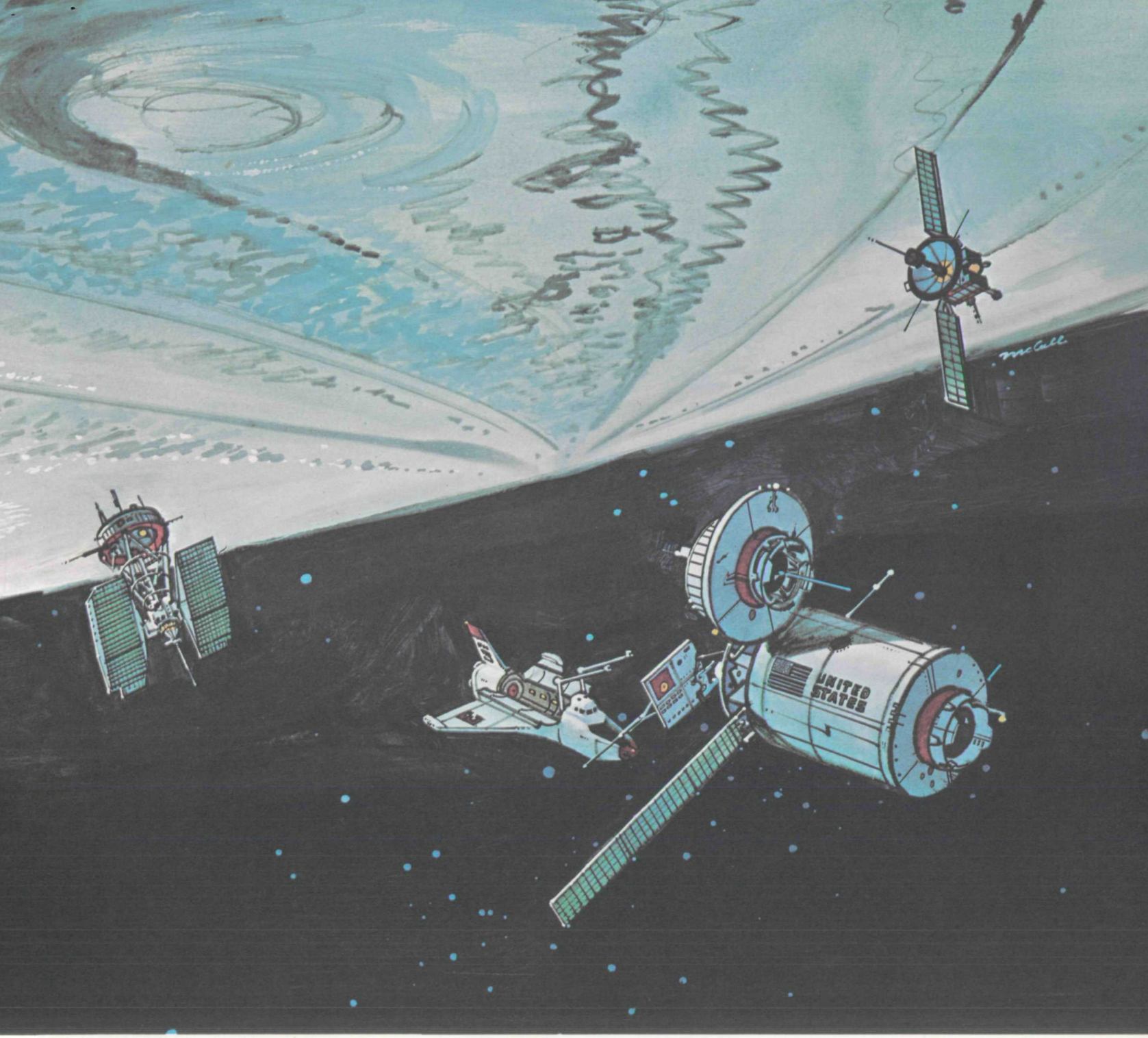
When operational, the Space Shuttle will replace all but the smallest U.S. space launch vehicles. It will launch and return weather satellites, communications satellites, pollution control satellites, Earth resource satellites, navigation satellites, scientific satellites and space probes. It will provide launch services for the Department of Defense and other agencies of the U. S. Government, foreign countries, private industry and research organizations. It will operate as a common carrier, serving essentially anyone who can buy a ticket or pay the freight cost.

Passengers need not necessarily meet the present stringent physical standards for space flight. They may be scientists, engineers, technicians, journalists, television crews or others whose business takes them into space. As experience increases the assurance of safety, men and women of many organizations and many countries will be among the passengers.



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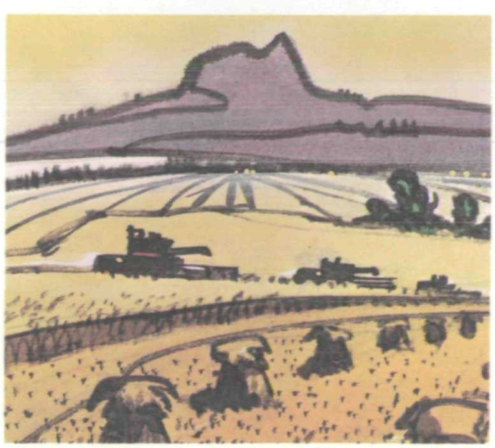

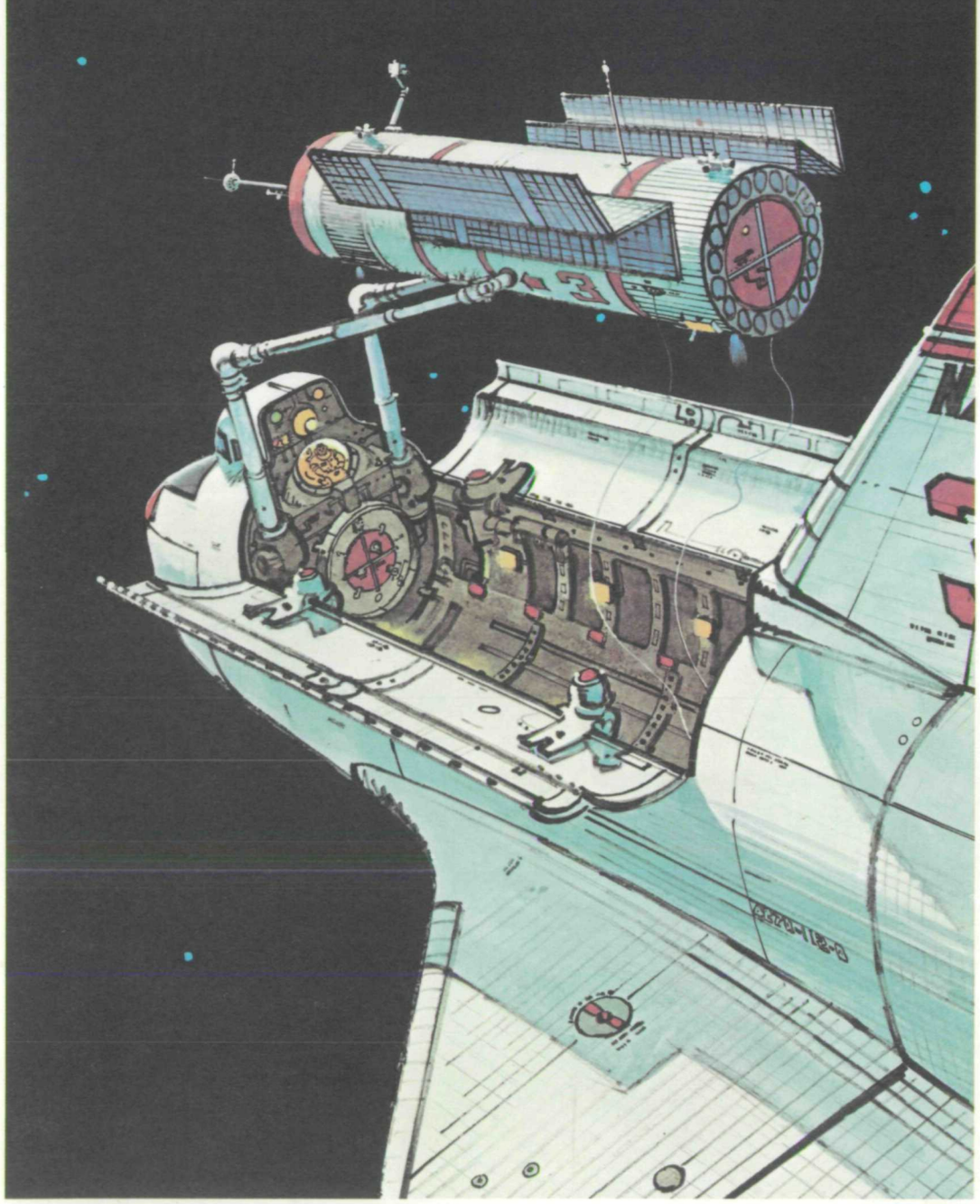

As costs decrease, preparation times shorten and operations are simplified, new uses of space flight will develop. Among those now envisioned are the manufacture of high-cost, high-purity products like vaccines, exotic metal alloys and special castings. Industrial researchers expect the weightlessness of space will lead to economic advantages that will warrant the cost of space activity.

Scientists are also considering how to collect the Sun's energy in space and convert it to electrical power for transmission to Earth without pollution.

But scientific leaders believe the most significant benefits to people on Earth will come from inventions not yet conceived, which will be stimulated when the Shuttle makes space flight simple, less time consuming and less expensive.

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