

# SCIENCE

## SPACE

### Perfection Plus 1%

Although it rose no higher than 266 miles above the earth during its eleven-day mission in space, Apollo 7 and its three-man crew last week lifted U.S. space officials to new heights of optimism. "Apollo 7 goes down in my book as the perfect mission," said Lieut. General Samuel Phillips, Apollo program director. "We achieved 101% of our objectives in this flight. This is a very major step toward the manned lunar landing, and I have every confidence that it will be accomplished by the end of next year."

Before they splashed down in the Atlantic 230 miles south of Bermuda, Apollo 7 Astronauts Wally Schirra, Walter Cunningham and Donn Eisele had completed 163 revolutions of the earth, compiled more man-hours in space than all of the manned Russian flights combined. They conducted scores of experiments, produced the first U.S. live TV shows from space and rendezvoused with their discarded Saturn 4B booster (see color pictures). More important, by checking out Apollo's control, navigation, communications and life-support systems, they confirmed that the craft was completely spaceworthy. If no unexpected difficulties are uncovered as technicians decipher the mountain of data that accumulated during the flight, an Apollo 8 crew composed of Frank Borman,

NASA



SCHIRRA, EISELE & CUNNINGHAM ON CARRIER FLIGHT DECK

*Longer than all the Russians combined.*

James Lovell and William Anders may be sent into orbit around the moon within as little as six weeks.

**Buoyant Bags.** Successful though it was, the mission ended in tension. For several minutes after splashdown, there were fears that an accident at sea had nullified Apollo's triumph in space. After a last voice transmission by Command Pilot Schirra from only 200 feet above the surface, Apollo lapsed into unscheduled silence; recovery helicopters from the aircraft carrier *Essex* flapped blindly through rainsqualls and fog in a vain search for the spacecraft. Then, suddenly, the helicopters reported that they had picked up Apollo's homing signals. The spacecraft was only a third of a mile from its selected landing spot.

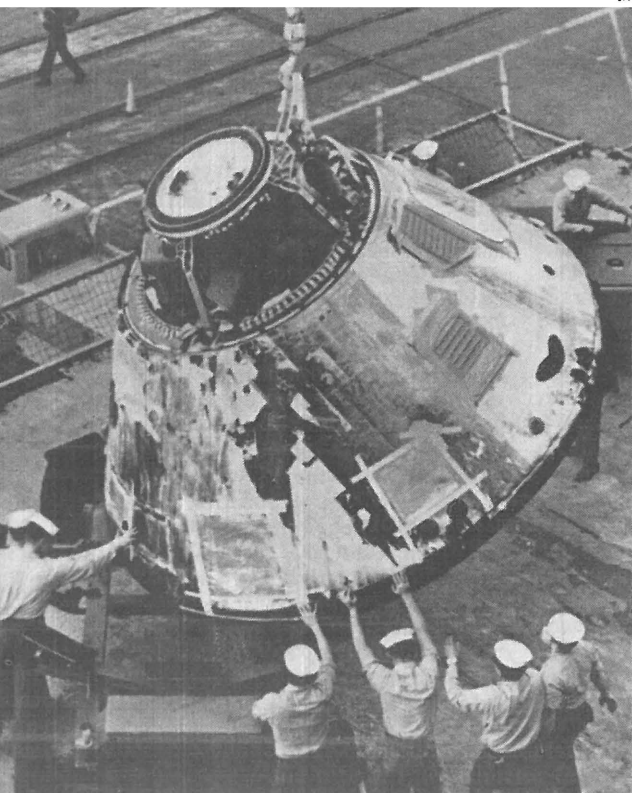
Apollo's temporary silence was easily explained. As the cone-shaped spacecraft hit the ocean, it was capsized by a combination of gusty winds and choppy waves. With the capsule in a nose-down position, its submerged antennas were useless. But the astronauts, trained for such contingencies, had to inflate three flotation bags attached to Apollo's nose. As the bags became buoyant, they swung the nose toward the surface until the spacecraft flipped upright, exposing the antennas and allowing radio transmissions to be resumed.

Ferried to the *Essex* by helicopter, the three heavily bearded astronauts walked unsteadily, obviously weary after their long confinement. But NASA doctors reported that despite colds, loss of weight (Schirra 4½ lbs., Cunningham 8, Eisele 10),

and muscles weakened by inactivity, the three space travelers were in good health—and in better humor than they had been for most of the week. The irritability that they had displayed during exchanges with ground controllers, said the doctors, was a natural consequence of long confinement, a rather humdrum flight and troublesome head colds. NASA's Paul Haney had another explanation: "Something happens to a man when he grows a beard," he quipped. "Right away he wants to protest."

**Fogged Windows.** The space doctors' worst fear—that the cold-plagued astronauts would suffer ear damage during re-entry—was not realized. As Apollo's cabin pressure was raised from the 5.3 lbs. per sq. in. maintained during space flight to sea-level pressure of 14.7 p.s.i., the astronauts protected their ears by removing their helmets and performing the "Valsalva maneuver" (named for its inventor, the 18th century Italian anatomist Antonio Valsalva). Holding their noses, closing their mouths and trying vigorously to exhale through their nostrils, they forced air through their clogged Eustachian tubes to keep the pressure in their middle ears equal to the increasing cabin pressure. The tactic worked perfectly, preventing pain and possible rupture of their eardrums.

NASA officials reported that, like its crew, the Apollo spaceship experienced only the most minor ailments during the 260-hour eight-minute flight. Some of the spacecraft windows fogged over for still-unexplained reasons; an oxygen-flow sensor misbehaved and unnecessarily flashed a red light; batteries did not recharge as fast or as fully as expected; current overloads twice tripped circuit breakers, cutting off electrical power until the crew reset the breakers. The otherwise flawless performance was a tribute to the corrective program instituted by NASA and North American Rockwell Corp., Apollo's prime contractor, after the disastrous Cape Ken-



APOLLO 7 BEING UNLOADED FROM "ESSEX"

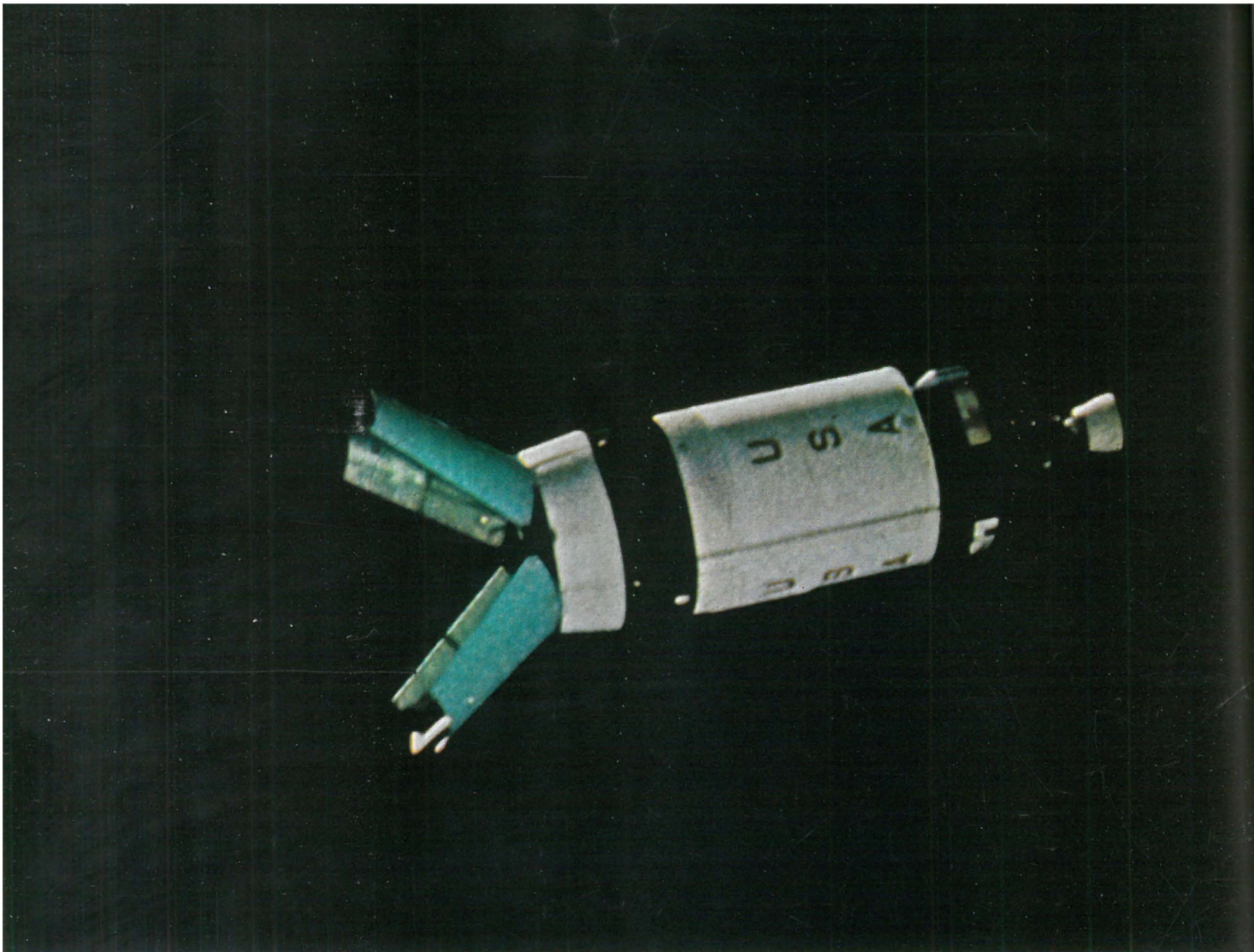
*Only the most minor ailments.*



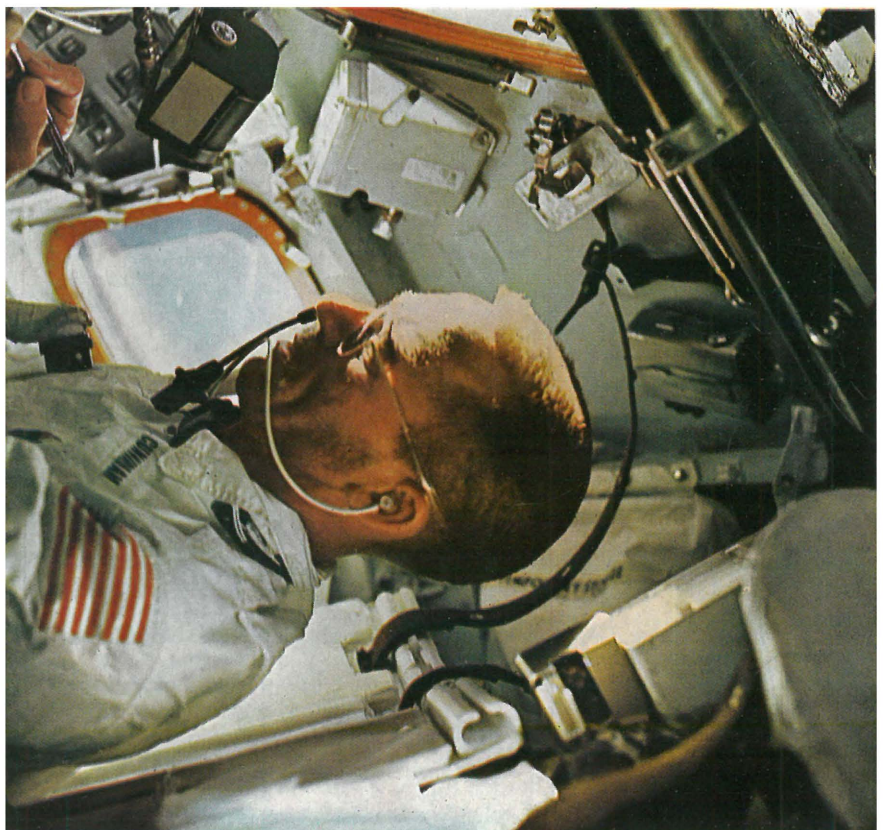
PHOTOGRAPHS FROM NASA

## APOLLO'S TRIUMPH

Directly over Cape Kennedy, Florida (*lower left*), the view from Apollo 7 during rendezvous shows Saturn 4B booster 100 feet away. On Moon landing missions, white disk visible on booster will guide Apollo as it docks with lunar module, which will be nestled inside open flaps.



During rendezvous maneuver, sunlight illuminates the S-4B as it tumbles in orbit against the darkness of space.



In orbit, Astronaut Walter Cunningham records data while film magazine floats weightless near his hand.

nedy fire that killed three astronauts in January 1967.

The highlights of the flight were the docking maneuver and precise rendezvous with the discarded S-4B booster, and the eight successful burns of the service module's powerful propulsion engine. These operations will be essential on a lunar landing mission. While en route to the moon, the joined Apollo command and service modules must dock with the lunar module (LM), which will be carried inside the opened flaps of the S-4B. Later, should the LM become stranded in a lunar orbit on its way to or from the surface of the moon, Apollo would have to rendezvous and dock with it in order to rescue the two astronauts aboard. Even more important, the propulsion engine will have to fire without fail to place Apollo in lunar orbit, and fire again to kick the spacecraft back toward the safety of the earth.

### Plus One More

Even as the U.S. proudly hailed Apollo 7 and its crew, the Soviets launched an impressive reminder that they are still running hard in the race to the moon. With no advance fanfare, Russia's tenth manned spacecraft, Soyuz 3, soared into orbit, piloted by fledgling Cosmonaut Colonel Georgy Beregovoy, 47. On the craft's very first pass around the earth, he made a rendezvous with Soyuz 2, an unmanned spacecraft that had been fired aloft the day before.

As always, Soviet officials were cautious and cryptic when they reported the results of the maneuver. The two ships, they said, had closed to within 650 feet of each other under "automatic control." Then Beregovoy took over and flew even closer. Whether he actually completed docking was not made clear.

Not until the Soviets, in their own good time, release more information will U.S. space scientists be certain of the significance of the flight. It is the first manned Russian space mission since April 1967, when Colonel Vladimir Komarov was killed in the crash of Soyuz 1. It seems almost certain that it is ultimately aimed at the moon; for one thing, the time is not right for a trip to any of the planets.

The Russians may be merely practicing hook-up procedures, a maneuver that U.S. spacemen have already perfected, or building an earth-orbiting space station. Indeed, there were suggestions that before the week ended a third capsule might be launched to join the first two. But the Russians may also be assembling the pieces of a composite spaceship, bound for the moon. U.S. space experts studied that technique years ago and abandoned it as too expensive. The Soviets' last space shot, a circumlunar mission powered by a giant booster, suggested that they too had made the same decision. Now, no one can be sure. U.S. spacemen could only watch, wait and worry about where they stand in the lunar sweepstakes.

## BIOLOGY

### The Puzzle of Aging

When it leaves the ocean to swim up the rivers of the Northwest and spawn, the Pacific salmon is lithe and healthy. As little as two weeks later, it degenerates into an aged, colorless and almost lifeless fish. Its flesh wastes away, bones soften, and skin peels off. The secretion of mucous material that keeps scales healthy suddenly stops, and the fish falls prey to fungus infections. Tiny parasitic worms multiply and spread through the fish's body; some glands run wild, others cease functioning.

What causes this piscatorial version of *The Picture of Dorian Gray*? Now, after studying the salmon for six weeks during a Pacific voyage aboard the oceanographic ship *Alpha Helix*, 40 scientists and doctors have returned to the U.S. with some provocative insights into the aging process.

**Out of Fuel.** Aboard the *Alpha Helix*, Biochemist Eberhard Trams of the National Institutes of Health discovered that the brain's control of the pituitary gland was a major factor in the sudden aging of the salmon. As the fish enters fresh water, he found, the pituitary quickly grows to more than twice its normal size, and the central nervous system fails to maintain control. The gland then triggers a metabolic speedup that burns away practically all of the fat in the salmon's body. Biochemist Andrew Benson, associate director of the Scripps Institution of Oceanography, explains: "It is as though all the glands were programmed to cause the combustion of fat simultaneously so that the whole machine runs out of fuel."

Another effect of the fresh water, says Benson, is to stimulate the production of a hormone that causes calcium to dissolve out of the bones. The bloodstream is thus supplied with calcium that is no longer available from the calcium carbonate in ocean water—but the cost is high. The salmon's bones soften and virtually dissolve.

**Clogging the Arteries.** Both the pituitary gland changes and the loss of bone calcium in salmon are also familiar symptoms of aging in humans. "But in the fish," says Biochemist Trams, "the gland goes to hell in two weeks, a process that takes some 20 to 40 years in man." Thus the salmon makes an "ideal laboratory tool" for the investigation of geriatric ailments.

The salmon, Benson suggests, may eventually provide researchers with clues to methods for lessening the ravages of aging and with new knowledge of arteriosclerosis, which is caused at least in part by high concentrations of cholesterol in the bloodstream. In the ocean, the salmon has from five to ten times as much cholesterol in its bloodstream as a human can tolerate. "If we find out how the salmon manages to survive with this much cholesterol," says Benson, "perhaps we can help humans survive also."

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