LUNAR EXPLORATION

Apollo Landing Site Choices

Aided by 28,635 photographs, space officials now have a leading candidate for the spot where the first astronauts will land on the moon.

It is not a spectacular spot, full of jagged mountains or huge craters, but a bland, smooth plain, located just a few miles north of the lunar equator and about one-third of the way in from the right-hand edge. It has no name, and space officials simply refer to it by the unromantic title of IIp2, meaning the second primary landing site of the 13 photographed by Lunar Orbiter II.

IIp2's smoothness, in fact, is the very reason that it seems promising. For a safe landing, nothing looks worse than boulders, craters and rays all over the place.

The landing spot should have no more than a seven degree slope, which means a rise of less than one foot for every eight feet horizontally, says Dr. Leonard Reiffel of the National Aeronautics and Space Administration. Nor should there be any rocks bigger than two feet across, "because we don't want to worry the radar altimeter" in the Apollo spacecraft.

The next Lunar Orbiter, scheduled to be launched between Feb. 3 and 7, will probably photograph IIp2 again, along with several other sites at which scientists want another look. Orbiter 1 photographed it too, and the next Surveyor will probably land softly in the vicinity.

Apollo landing sites will be picked in bunches of three, spaced 26 degrees apart to give the astronauts several passes if they need them. Each site will measure about three by five miles, and before astronauts land on it they will have flown computer simulations of the whole mission, using detailed maps made from Orbiter and Surveyor photographs.

Detail is limited by the altitude from which the pictures are taken, but NASA says that the Orbiters, which cannot take pictures below about 24 miles because their angular movements then become too great for their anti-blurring equipment, get close enough. Actually, both have been down to less than 17 miles, but only with cameras turned off. The "nominal" altitude is 28.5 miles, but twice a month the earth's pull is in just the right direction to drag them down as much as five miles farther.

Of Russia's two orbiting mooncraft, Luna 12 approached nearer to the surface, about 60 miles. Luna 10 reportedly got no closer than 210 miles.

U.S. Orbiters 2 and 3 will, at least for a while, travel around the moon at the same time, which 1 and 2 did not. Because of correction maneuvers such as trying to get lower to compensate for a stuck camera shutter, Orbiter 1 used up most of the gas in its attitude control jets, so NASA decided to crash it rather than have an uncontrollable satellite in space around the moon. Orbiter 2 is behaving much better, and unless its transmitter refuses to turn itself off on command, possibly causing confusion on earth in separating the incoming data from the two spacecraft, it should be allowed to keep number 3 company for as long as six months.

HIGH ENERGY PHYSICS

Bioscience From Nuclear Particles

Scientists at CERN, Europe's collaborative answer to American leadership in fundamental nuclear science, have come up with a striking possibility for medicine, paralleling U.S. work.

CERN physicists report that the pi meson, one of the elementary particles of matter studied, may be useful for cancer treatment.

Beams of pions, they say, could destroy deep-seated, inoperable tumors. Early, preanimal research has already been conducted.

"The advantages of pions for the destruction of malignant tissue lie in the nature of their interaction with matter," explains Dr. Johann Baarli of Norway, chief of the health physics group.

"Negative pions are most likely to interact at the end of their penetration paths. So if their energy is carefully selected, they can pass harmlessly through healthy tissue to the tumor region.

"There they are 'captured' by nuclei and interact with nuclear matter, emitting a high proportion of short-range, heavily ionizing protons, alpha particles and nuclear fragments.

"Since such reactions are particularly dominant in elements such as oxygen, carbon and nitrogen—the main components of human tissue—a beam of negative pions offers a new way of producing highly localized radiation in the body."

Moreover, CERN's group knows from medical colleagues that tumor cells often suffer from a lack of dissolved oxygen, making some cancers resistant to X-rays and gamma rays, most commonly used for therapy.

Such resistance has not occurred for radiation created at the end of the pions' range.

The pion beams now available at CERN are too low in intensity to try now to treat malignant tumors. The beams from CERN's synchrocyclotron would have to be increased 100 fold for practical experiments.

But several useful tests have already been carried out, the scientists say wryly, with "promising results . . . inspiring more experimental work."

Dr. Baarli and his team hope soon to move to the animal stage. Animals will be brought from institutes in European member countries, treated in Geneva, Switzerland, but studied by doctors in their own laboratories.

In the U.S., scientists at the University of California's Lawrence Radiation Laboratory in Berkeley have used the pion beam of the 184-inch cyclotron to conduct similar experiments.

Although most of the tests to measure the effects of radiation on living cells were made with beam roots, mice with tumors were also exposed to the beam. The mesons caused about two and a half times as many chromosome abnormalities in a simulated region of a tumor in bean sprouts compared to the region of healthy tissue.

There is no possibility now or in the near future of using mesons in human therapy. Berkeley scientists agree with CERN that this would have to await extensive additional research and the development, several years hence, of accelerators producing pion beams about 100 times more intense than available today.

Mesons came to the attention of biological scientists as a possible medical tool by the same route—exploring the riddle of matter—as such other tools as X-ray, radium and radioisotopes.