SPACE PHOTOS

For geodesy, selenodesy

At first glance, they look like ordinary, undistinguished photographs of the moon, prime candidates for some astronomer's wastebasket. Upon closer scrutiny, however, there appear some tiny, barely perceptible white flecks, which make these pictures unique.

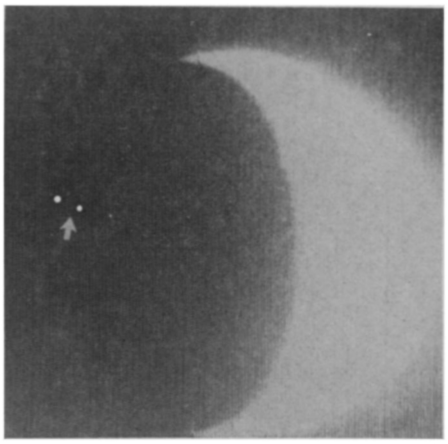
One of the pictures isn't of the moon at all. Instead, it shows a crescent earth, photographed from the moon by the television camera aboard the Surveyor 7 spacecraft. Faintly visible on the earth's dark edge are a pair of small, light smudges. These are laser beams, shining up from the earth almost a quarter of a million miles away.

One of the spots—the farther of the two from the light crescent—originated in California, where it was projected through a 24-inch telescope at Table Mountain Observatory near Wrightwood. The other was sent moonward through the solar telescope at Kitt Peak National Observatory, some 500 miles away in Arizona. The beams, which began less than an inch in diameter, because of their coherent light reached the moon still only a few miles across. This is why they were visible at all—their light was concentrated into a narrow cone with an angle of only about three seconds of arc.

Four other laser beams were shining at the moon at the same time, but they don't appear to be visible in the photograph. They had several things going against them: weather, the fact that they were farther east and thus nearer the obscuring glare from the light side of the earth, and the fact that only one of them had its beam boosted by passing through an observatory telescope. The researchers, however, including Drs. Carroll O. Alley Jr., and Douglas G. Currie of the University of Maryland, have been processing the photo and others like it with a computer to exaggerate the differences between shades of gray, in hopes of finding a pattern of gray tones that matches the locations of the four missing spots. The search, Dr. Alley hopes, will bear fruit this week.

Besides communicating with astronauts, earth-to-moon lasers could be valuable tools for pinpoint measurement of the orbits of both spheres, as well as for studying other phenomena including the possibility of continental drift.

A second remarkable space photo, released last week by the space agency, does show the moon, but with one additional detail never before found in a picture of earth's natural satellite: a manmade spacecraft in orbit around it. Like the laser spots, the craft appears only as a smudge, marked by the sunlight reflecting from its solar panels. The vehicle is Lunar Orbiter 5, last of its kind, photographed through a 61-inch telescope only 10 days before mission controllers signaled it to crash onto the lunar surface.

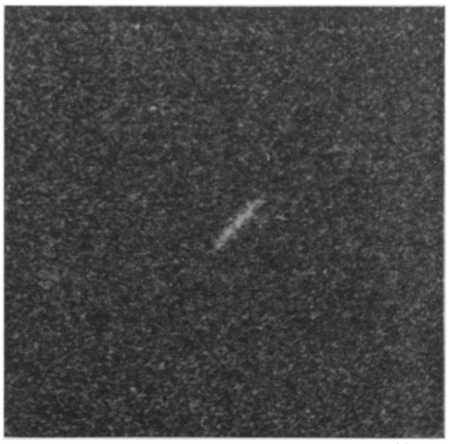


NASA

Surveyor 7 seeing spots on earth.

Light-proof baffles were placed around the telescope to prevent confusing multiple images on the photographic plates, but to be on the safe side, scientists took some 80 photos of the sky where Orbiter was expected to be.

It appeared in 52 plates each time as a line instead of a point, due to the exposure time of 5 or 10 seconds and to the combined motion of the moon around earth and the spacecraft around the moon.



NASA

Lunar Orbiter 5 photographed on duty.

Measurements of these lines, together with orbital coordinates and NASA radar tracking data, will enable more accurate measurement of the distance between the moon's center of mass and its visible limb, or edge.

RESEARCH BUDGET

Defense looks to solid state

In future funding of physical science research the Department of Defense intends to take a hard line—what might almost be called a hardware line. Departing Secretary Robert S. McNamara told the Senate Armed Services Committee during February that research projects must be relevant to long-term national defense needs to merit DOD support.

A few days later, Dr. John S. Foster Jr., director of Defense Research and Engineering, added testimony that such projects should be "coupled and integrated wherever feasible with the anticipated needs of advanced and engineering development programs."

The sort of coupling and the length of term they have in mind is perhaps to be read in Dr. Foster's later warning that payoffs from research can be expected only after a number of years—at least 10. The payoffs to be sought are new capabilities, improved operations, and reduced cost.

Historically some branches of physical science have not paid off so fast. It was more than 40 years from Michael Faraday's researches on electric fields (in the middle of the 19th century) until practical electric motors began coming into general use. Natural atomic radioactivity was discovered in the middle 1890's; practical development of power-producing devices came in 1943.

To stay in the shorter time-spans DOD is bowing out of high-energy nuclear physics (SN: 2/10 p. 136), but will continue to support solid state physics.

High-energy physics nowadays is far beyond any relevance to defense needs—certainly not in 10 years and probably not in 40.

In fiscal 1969 the Department proposes a 50 percent cutback in its high-energy support; in fiscal 1970 DOD wants to get rid of high-energy physics entirely.

How much money is involved is difficult to determine. "Physical Sciences proper" is the narrowest category into which published budget figures are broken down, and this includes items that DOD intends to retain and even strengthen. For this category the Department spent 53 percent of its basic research funds in fiscal 1967, about $152 million. In the same year all government agencies together spent $1 billion for basic research in physical sciences proper. The Defense Department spent less than the Atomic Energy Commission ($218 million), and the National Aeronautics and Space Ad-