clean exhaust." He recommends lower-compression engines, much reduced in size and power, plus engineering innovations such as stratified charge engines. But he says Detroit's insistence on continuing to produce large, powerful machines means that the engineering turnaround may have to be forced on the manufacturers.

Such a turnaround, as well as the restrictions on autos in cities and the building of mass transit systems, will require massive public support, which to date has not been forthcoming. Although some cities, such as San Francisco, and, more recently, Atlanta, have approved large public transit systems, many more such projects have been defeated. Such a defeat appeared this week possibly to be the fate of the Washington, D.C., Metro system, already under construction. The House Appropriations Committee voted 31-13 to deny more funds to the big subway project.

Although Metro's defeat may have been based more on traditional deference to a subcommittee chairman who opposes the project than upon any feelings about subways, still the comparative levels of funding by Congress for highways and urban mass transit reflect Congressional apathy toward transit systems. The Highway Trust Fund receives some $5.6 billion a year in Federal funds; the Urban Mass Transit Administration gets about $400 million.

But there are signs a change may be coming. President Nixon personally intervened in the Metro dispute, asking for appropriation of the funds. And a recent survey by the Highway Users Federation for Safety and Mobility—a pro-highway group—shows that 57 percent of a broad spectrum of Americans favored limiting cars in urban areas. The figure rose to 66 percent when only urban respondents were considered. But most surprising was the willingness of 60 percent of urban dwellers to limit their own use of autos in cities. (These figures were not issued by the Highway Users Federation, which released the portions of the poll most favorable to its position, but rather by Ben Kelley of HAC, who obtained a copy of the complete poll.) Other signs of changing attitudes are reflected in increasing Congressional restiveness displayed in proposals to convert the now sacrosanct Highway Trust Fund to a Total Transportation Fund, giving local governments the right to decide whether grants should be used for highways or urban mass transit.

But perhaps most significant are new attitudes being displayed by corporations. Some oil companies, such as Gulf and Mobil, are now speaking favorably of urban mass transit—perhaps because of threats to their Mideastern oil supplies. And General Motors Chairman James L. Roche told a dealers meeting recently that Americans are increasingly fed up with problems of servicing their cars. "The fact is that a dangerous and ugly climate of dissatisfaction and distrust shadows the prospects of our industry," said Roche. This climate, if it does not force the automobile entirely out of cities, may, at least, produce some reforms. A major problem with emission control devices, for instance, is getting them serviced. If the dealers heed Roche's recommendation for better service, this could be a major gain for clean air. □

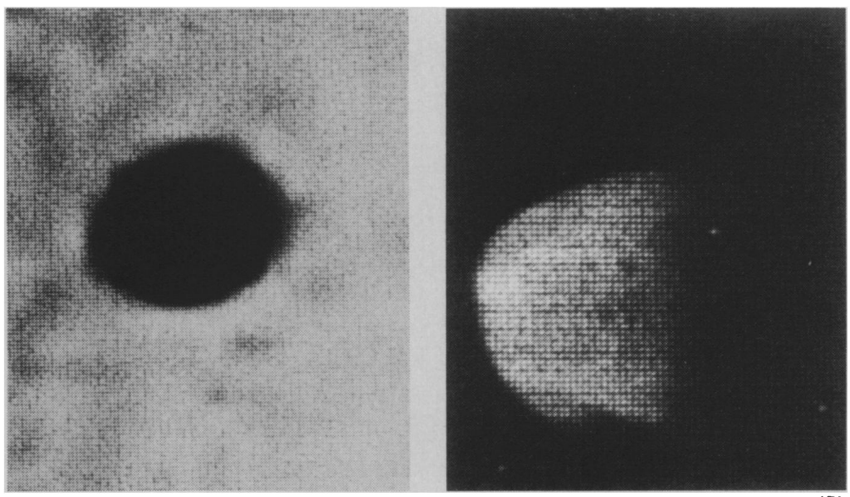
The lumpy miniworlds of Phobos and Deimos

It has been less than a century since the American astronomer Asaph Hall discovered the two moons of Mars—Phobos and Deimos—in 1877. Last week scientists viewing photos transmitted by Mariner 9 were getting their first close-up look at the tiny satellites. "This is a remarkable testimony to mankind—the first time man has seen up close the satellites of another planet," says Carl Sagan of Cornell University, "It's cosmogonical!"

Through the years, various theories have been developed for the origins of the tiny Martian moons: that they are chunks out of the parent planet; that they were formed at the same time as the parent planet and in the same general vicinity and captured by the parent; or that they were formed in other places of the solar system and then later captured. (The tantalizing idea that they might be a Martian civilization's artificial satellites was long ago discarded.)

Phobos and Deimos resemble the earth's moon on only two accounts so far. They have a low albedo and are cratered. That ends the similarity.

Both are shaped like a potato. Phobos, the closer to Mars and larger of the two, is about 16 kilometers pole to pole and 23 kilometers wide (SN: 5/23/70, p. 508). It revolves around Mars every 7 hours and 39 minutes—less than a third of the length of the Martian day and the shortest revolution period for any known satellite.



JPL

Mariner 9's views of Mars' elongated satellites, Phobos (left) and Deimos.

Deimos is almost 9 kilometers through the poles and 11 kilometers across. Its revolution period is 30 hours and 18 minutes. The first unenhanced picture of Deimos reveals a dark area in the southern region that could be a cleft about one kilometer deep.

The nonspherical, lumpy shapes may hold the key to the origin of the moons. Planets have enough total mass and surface gravity that hydrostatic pressure evens them out into spheroidal shapes.

The Martian moons, on the other hand, must have enough rigidity to maintain their shapes. "For their size," says Hal Masursky of the U.S. Geological Survey, "the moons are stronger than the earth."

What could the moons be made of? Their low albedos—similar to that of the dark basaltic areas of the moon—suggest they could be composed of basalt. That would mean that they originated from a larger body that had been melted. But the material also is similar in appearance to the carbonaceous chondrite meteorites. This would fit nicely with the theory that the moons are captured asteroids. If so, Mariner 9 will have been "a free mission to an asteroid," quips Sagan.

But it is much too early to tell. Scientists will, however, be able to begin charting the rotational velocity of the moons, calculating their masses and densities and mapping their surfaces. □