NEWS AND VIEWS

Noises Underground

THIS has been a busy year for testing nuclear weapons underground, both in the United States and the Soviet Union.

In the United States, tests are back in the limelight if not in the daylight. Last week the U.S. Atomic Energy Commission held one of the largest underground tests so far in a hole drilled 4,000 ft. into the Nevada desert. It must have seemed like old times in Las Vegas, 100 miles away, where buildings were shaken by the explosion. The Atomic Energy Commission has attributed the explosion to a thermo-nuclear device exceeding 100 kilotons in power and intended as part of a programme to develop warheads for anti-missile systems. The explosion in Nevada, the thirty-fourth in 1966, was preceded by none of the drum-beating which attended the explosion earlier in December of a nuclear device in an underground cavern at Hattiesburg, Mississippi, and intended to test the theory that underground explosions produce less intense seismic disturbances if they take place in voids. (Apparently the device, equivalent to 380 tons of T.N.T., was too small to be of much value.) An explosion similar in size to the large underground explosion in the United States took place at Novaya Zemlya in the Soviet Union on October 27, 1966, and this is also assumed to have been part of a programme to develop anti-ballistic missiles—a subject that will exercise strategists and politicians in Washington between now and the approval of the defence budget in the spring.

In the United States, interest in underground explosions has also been fired, in the second half of 1966, by the prospect that the Atomic Energy Commission may yet be able to turn them to commercial account. Talk of using underground explosions to release petroleum from oil shale has led, at last, to what is called "Project Gasbuggy"—a scheme in which the commission will explode a 20 kiloton device in the sandstone of north-western New Mexico to see whether shattering the rock can increase the flow and recovery of the natural gas it contains. The El Paso Natural Gas Company is prepared to foot one-third of the bill, expected to be $4·7 million. Two petroleum companies from Houston, Texas, are waiting in the wings, asking for one 40 and two 50 kiloton explosions in Colorado. If the experiments prove that nuclear explosions can help commercially with the exploitation of underground gas reservoirs, one of the two companies from Texas would like the commission to carry out at least fifty explosions underground—a task that would require a revision of its charter. Indeed, the petroleum industry proper would like to see the commission experiment with the oil shale under the Rocky Mountains, but there are many people, Professor John Galbraith among them, who remain to be persuaded that the exploitation of new reserves is as urgent as the companies say.

Craters on the Moon

THE Russian rocket *Luna*-13 which reached the Moon a week ago, and the United States Surveyor due to follow in February, are both intended to glean some information about the physical properties of the surface material of the *maria*. By all accounts, the Russian instrument has been a success, so that there are reasonable hopes of some primary data about the surface of the Moon during 1967. At the same time it is clear that the necessarily restricted range of the new instruments will leave room for more traditional studies, although these have been stimulated in several ways by the photographs of the surface of the Moon which are now available.

Photographs obtained by the rockets in the United States Ranger series have, for example, made it possible to extend to much smaller dimensions the frequency distribution of lunar craters of different sizes. Thus Cross, writing in the *Monthly Notices of the Royal Astronomical Society* (**134**, 245; 1966), has re-examined the statistics in the light of photographs obtained by *Rangers* 7, 8 and 9 from three points on the surface of the Moon—the *Mare Nubium*, the *Mare Tranquillitatis* and the crater *Alphonsus*. He finds that even the smallest craters can be represented by an inverse square distribution which also includes the larger craters, up to 10 km across, which appear in the standard atlases of the Moon. Specifically, the number of craters per million square kilometres of surface (N) with diameter greater than X (metres) is accurately represented by C/X^2, where C is a constant differing from one place to another. The distribution includes craters as small as 65 cm in *Mare Nubium*, 75 cm on *Alphonsus* and craters with diameter 1·6 m in *Mare Tranquillitatis*.

An inverse square frequency distribution of crater size is not in itself a novelty, of course. Independent surveys of the surface of the Moon by Shoemaker and Hartmann have suggested that, for the visible surface of the Moon as a whole, N is proportional to $1/X^2$ whenever X is greater than 1 km or so. With X less than 1 km, however, it appears that N is proportional to $1/X^{3.6}$. On the assumption that most craters are caused by meteoritic impact, this excess of smaller craters in the overall distribution may be accounted for by the lumping together of primary craters and the secondary craters formed by the impact of material ejected from primary craters. The fact that the statistics for limited regions of the surface of the Moon seem to accord well with an inverse square relationship supports this interpretation, especially where the two *maria* are concerned. Moreover, the Ranger data as a whole support the concept of meteoritic impact as the principal cause of cratering on the Moon, if only because it is hard to see how any other mechanism could adequately lead to a frequency distribution which is an inverse square relationship over at least five orders of magnitude.

Traffic in Britain

BRITISH cities recovering from the unprecedented congestion of Christmas will need little persuasion that the five years ahead are likely to be critical for the development of transport in Britain, but all doubt will be removed by the latest report of the Ministry of Transport (*Roads in Britain*, H.M.S.O., 10*s*. 6*d*.). This document, which is also the first annual report to appear since Mrs. Castle became Minister of Transport, is preoccupied with growth and with the problems it will bring. The volume of road traffic will increase by a third by the end of the decade, and will double