Aberdeen is not a representative British university—most of its students come from Scotland and about half of these stay there—and comparable statistics from other universities are not apparently available. But some of the results, such as the differences in the migration rates of arts and science graduates, are unlikely to depend on the nature of the university's intake. Mr MacKay draws attention to the need to know what happens to graduates after their first job. In 1951, for example, 11 per cent of the men in his sample emigrated immediately, but 24 per cent of the sample were working abroad when they were last contacted. In other words, arguments based on British universities' information about where their graduates go when they leave may greatly underestimate the size of the brain drain.

SPACE COLLABORATION

French Lasers on the Moon

from a Correspondent

THE latest report of the joint French-Soviet committee concerned with the cooperative space programme, agreed in principle in 1966, shows some changes of direction. The committee meets once every six months, most recently in Paris shortly before Christmas. The Soviet delegation is headed by Academician B. N. Petrov, chairman of the Council for International Cooperation in the Study of Outer Space ("Interkosmos") of the Soviet Academy of Sciences. The chief French representative is Professor J. F. Denisse, president of CNES (Centre Nationale pour l'Espace Scientifique). Earlier last year a scheme to launch a sizable satellite from the Soviet Union with French instruments had to be cancelled because of French financial difficulties. Now a collection of projects which have not previously been mentioned is taking the field.

Most striking is a plan to land French laser reflectors on the Moon in 1970. A laser ranging experiment was carried on one of the first French national satellites, with pleasing results. No further details are available about the joint project, but clearly the experiment relies on a soft-landing mooncraft, presumably of the Luna lander type. (Luna 9 was the first Soviet mooncraft to make a soft landing.)

There is also a project for creating a radio-interferometer with the Earth-Moon distance as a baseline. The first step is being taken by the radio observatory at Nancy, partly with the help of Soviet equipment. The intention is to study radio sources at a wavelength of 18 cm.

It has also been decided to launch high altitude balloons in the Soviet Arctic (Archangel) this spring. It is not clear whether these will be the large floating physics laboratories or the constant pressure orbiting meteorological balloons that the French have pioneered in the southern hemisphere as an elegant method of obtaining continual surveillance of the high altitude weather. This concept has gone through several phases. It was originally proposed as an international geophysical programme, not limited to meteorological measurements, by an American physicist in the planning for the International Years of the Quiet Sun. It promptly ran into trouble with the Soviet authorities. Sub-satellite altitude overflights, even by unmanned

balloons, were considered ambiguous. The same difficulty seems to have arisen with the French Eole and American-New Zealand GHOST projects when suggestions were made for extending them to the northern hemisphere. The fact that the balloons are scarcely a metre in diameter and the payload is measured in milligrams seems not to have counted. There has been a sense that the Soviet attitude was softening, but in the northern hemisphere there is still Chinese opposition to contend with. For full usefulness, measurement of the constant pressure orbiting balloons needs to be made simultaneously along at least three bands—southern and northern hemisphere and equatorial—and also around a line of latitude. But now a start seems to have been made, and a two-way direct line, Kerguelen-Paris-Moscow-Archangel, is being put in for this experiment.

IONOSPHERE

Satellites' Satellites

THE launching of the Interkosmos series of satellites opens a new phase in the near-space research programme of the Soviet Union, since (as the name suggests) the principle of Interkosmos is that of a joint venture between Russia and her eastern bloc neighbours. The general aim of the Interkosmos programme is the investigation of the ionosphere; Interkosmos-1, launched on October 14 last year, studied the ultraviolet and X-ray emission of the Sun, and its effect on the upper layers of the atmosphere, while Interkosmos-2, launched on December 25, is designed to study the characteristics of the Earth's ionosphere, including the concentration of electrons and positive ions, the electron temperature close to the satellite and the mean concentration of electrons between the satellite and the ground-level receiving points. The equipment for these experiments was produced in Czechoslovakia, East Germany and the Soviet Union, with the addition, in the case of Interkosmos-2, of Bulgaria. The monitoring and recording of the satellite signals are shared between observatories in Bulgaria, Czechoslovakia, East Germany, Hungary, Poland and the Soviet Union, and in Cuba as well for Interkosmos-2. These observatories are also carrying out simultaneous ionosphere investigations, apparently for control purposes.

The orbit of Interkosmos-2 is highly elliptical (perigee 206 km, apogee 1,200 km, compared with 260 km and 640 km for Interkosmos-1). The initial period is 98.5 min, compared with the 93.3 min of Interkosmos-1, and the inclination of 48.4° is the same for both satellites.

The experiments carried by Interkosmos-2 include two spherical ion traps (a Bulgarian/Soviet experiment) to measure the positive-ion concentration along the whole extent of the orbit, the primary data being stored in the on-board memory unit for later transmission; a high-frequency probe (joint Czech/Soviet experiment) for measuring the ionosphere electron temperature; and two cylindrical Langmuir probes (joint East German/Soviet experiment) intended to investigate "the physical features of the ionosphere" and a two-frequency "Mayak" radio transmitter which, besides transmitting data, provides a means of determining the electron distribution in a vertical column between the observation post and the satellite.