the first Moon landing, economizing on time was the essential feat. An outstanding engineer such as Mueller was a logical choice.

But even with the second manned Moon landing, speed begins to take second place. Quality of results is becoming the criterion. Indeed, the lunar strategy review of the National Academy of Sciences Space Sciences Board (see *Nature*, **224**, 529; 1969) specifically urged that there should be longer intervals between missions to give time for results to be digested and fed into the programme of future flights and that more time should be spent on the Moon with more selectivity in data collection. Several of these points have already been adopted for this week's Apollo 12 mission. Twice as long is to be spent on the surface, and twice as much material is aimed for, with emphasis on sample selection. Six experiments are being performed instead of three.

Dr Mueller's successor has yet to be announced, but most of the other personalities behind the Apollo 11 flight have already been replaced. There was even some speculation about how the Apollo 12 mission would get on with so few of the old familiar faces.

SCIENCE RESEARCH COUNCIL

Shoe Pinches in Physics

THE Physics Committee of the Science Research Council, responsible for dispensing roughly £1 million a year on physics research in British universities and institutes, has produced a modest echo of the complaint elsewhere that other sources of support "for good fundamental work" have diminished. The committee has carried out and now published a review (to be had free of charge from the Science Research Council) of the fields in which it is at present engaged and of the directions in which it may find its work developing. It says that "on the national level . . . support from sources other than the SRC has decreased rapidly" chiefly because various government agencies have lost enthusiasm for various projects. The committee says that solid state physics and plasma physics have suffered most, no doubt because of the concentration of the defence research laboratories on practical applications of electronics and because of the decision by the UK Atomic Energy Authority to cut down on work at Culham, the laboratory particularly concerned with thermonuclear research. The committee estimates that it would take an extra £200,000 to £300,000 in the next two to three years to make sure that the national effort continues at "a reasonable though reduced level". One of the ironies of which the committee complains is that the short commons for solid state physics and plasma physics have come about precisely when the importance of these subjects is growing and when it is clear that "it is precisely from these fields that new technologies can confidently be expected to emerge".

The Physics Committee is not concerned with support for high energy physics or for astrophysics in the strict sense. In its review of the opportunities available, it has given prominence to the need for better facilities for neutron beam research, and spells out the advantages which may be obtained by a fuller exploitation of neutron beam experiments. Neutron diffraction in crystallography is already widely used, but the committee points to possible applications to crystals of biological molecules and the determination of magnetic structures. But there are also benefits to be won from studies of dynamical processes in crystals—phonons, magnons and the vibrations of polymer chains, for example. The committee says that the importance of this work "cannot be overemphasized" and that there is an urgent need of a high flux beam reactor.

The committee seems also to have been captivated by the potentiality of synchrotron radiation in the study of gases and solids and has spent £150,000 on a national facility for synchrotron radiation at the Daresbury Laboratory. Elsewhere, the committee promises more help for ion implantation studies in semiconductors and other solids, the study of the amorphous state and new developments in surface physics. It also seeks to encourage the use of on-line computers as a part of the general improvement of laboratory facilities. Further ahead, the committee is proposing to look carefully at opportunities in collisions between atoms and heavy particles at low energy, principally on account of their interest in chemistry and astrophysics; the development of dye lasers, in part because of the way in which such tunable lasers can provide selective excitation in atomic physics; energy transfer processes in solids; mode locked lasers which give pico-second pulses; ferro-electric materials and what is called "technological magnetism"; electronic structures in alloys; spectroscopy by laser scattering and non-linear optics; the electronic properties of polymers; inert gas solids; critical phenomena at low temperatures and tunnelling in superconductors. On the whole, the Physics Committee gives a convincing impression that it knows where it would like its pensioners to go. The review deals also with matters such as the growth and supply of crystals for research in solid state physics, now helped along by work supported by the Science Research Council at Oxford, Strathclyde and Birmingham as well as by the Electronic Materials Unit of the Ministry of Technology at Malvern. The committee promises to pay attention to the development of instruments. On training, it says with pride that "very nearly 50 per cent of our postgraduate students are working on applied rather than fundamental physics" and promises to foster cooperative research and training between industry and universities by directing something like 20 per cent of new research studentships towards work of this kind.

COMMUNICATIONS SATELLITES

Skynet Ahoy

from a Correspondent

THE logic of providing a communications satellite system for defence purposes just as Britain is completing its withdrawal of forces east of Suez is not immediately obvious. The chief object of the Skynet satellite, of which the first of two was successfully launched on November 22 by the American Thor-Delta, is to maintain instant interference-free voice communication between Whitehall and forces in the Middle and Far East. It may, however, provide Britain with valuable experience in designing and building advanced communications satellites components, and this is certainly an expanding technological field with substantial export possibilities.

Skynet is claimed to be the most advanced defence communications satellite system at present in existence. The only other one currently in being is the United States Air Force's Interim Defense Communications Satellite Programme (IDCSP) inaugurated in 1966. This has employed medium-orbit satellites of relatively low power, so the ground stations working them are required to be both highly manoeuvrable and rather large.

Britain has benefited from participation in the IDCSP. The Ministry of Defence was invited to make use of the satellites for test purposes—though strictly not for operational signals—and four ground stations were designed and built and all were ready in time to start operating as soon as the first bunch of satellites were up. The experience then acquired has been harnessed to the Skynet concept. Besides this, Skynet is inter-operable with the IDCSP system and is intended to be inter-operable with its successor now in view within a year or so. In addition, the contractor for the two first generation Skynet satellites is Philco-Ford, builders of the IDCSP satellites.

In fact, Skynet is several steps in advance of the current American military system. For example, it employs a geostationary satellite—40° E over the Indian Ocean—in place of the series of fast passing vehicles. It is not likely now that further military communications systems will use low-orbit satellites but it was a bold step before Early Bird. SRDE, Christchurch, now part of the Ministry of Technology, drew up system specifications.

Other features of Skynet are proving sufficient improvements over previous techniques to warrant copying. For example, the two-path transponder that enables small ground terminals to have equal and simultaneous access with large ones without being swamped is apparently being incorporated in the projected NATO satellite communications system. The advantage of this arrangement is that it permits terminal antennae only a few feet across to be effective, which in turn makes for mobility and flexibility, for they can be easily dismantled and flown to a flare up area. Of the ten terminals so far commissioned, only one—that at the headquarters station of Oakhanger—is truly fixed. Two, each 2 metres only in diameter, are mounted in ships.

The Royal Air Force is in overall command of the system, though each of the services handles one of the ground elements. The members of RAF Signals group are extremely pleased to have got into the space business, "and now the RAF has got in it does not intend to let go". It is pointed out that the thinner the forces on the ground the tighter the command must be. And this means faster communications.

CBW

Closing Pandora's Box

UNDER certain circumstances, inspection procedures for chemical and biological weapons have a fifty-fifty chance of success, according to Mr Theodor Nemec, of the Stockholm International Peace Research Institute. Mr Nemec was speaking at a meeting in London last weekend organized by the Women's International League for Peace and Freedom. The three-day affair, called primarily to discuss U Thant's report on chemical and biological weapons published in July, was run in an atmosphere of cheerful disorder. Scientists such as Professor Matthew Meselson of Harvard University and Dr John Humphrey, who is a member of the Pugwash subcommittee on CBW, found themselves talking to a committed audience when they spoke of the dangers of chemical and biological warfare. So did Academician Oganes Baroyan, director of the Gamaleya Institute of Epidemiology and Microbiology of the USSR Academy of Medicine, who was revelling in his role as the only speaker from the Soviet Union. But the meeting tended to be suspicious of the motives of some of the politicians who addressed them.

Mr Nemec said that the Stockholm institute was inspired by the Pugwash subcommittee on CBW to look at the pros and cons of inspection for chemical and biological weapons. The problem is of course that the lack of trust which gives rise to the need for inspection is the obstacle to its introduction, but the inspection procedure does not have to be 100 per cent efficient. What the institute has been doing is to look at ways of detecting whether CBW work is going on. It seems clear that larger factories than many people think would be needed to produce significant quantities of chemical and biological weapons, and Mr Nemec cited as an example the Pine Bluff Arsenal, Arkansas, which employs 1,800 people and has a daily water consumption equivalent to a London suburb. This is why the institute played a game with fourteen European laboratories in nine countries, including NATO, Warsaw Pact and non-aligned states. The aim was to see how useful on-site inspection would be. Two laboratories in Britain took part, the Wellcome Laboratory at Beckenham, and the Lister Institute. Inspection was by questionnaire and visits. The fact that one western European pharmaceutical company estimated that it had cost $10,000 to fill in the questionnaire was a measure of how searching was the document. The Stockholm institute had twenty-five inspectors drawn from thirteen countries, and they discussed the problem of inspection with some 100 other scientists. They then posed the following question: after a series of five visits by the same team, how effective would a sixth visit be in detecting a military CBW capability? The mean of the answers gave a 61 per cent chance of success, but Mr Nemec noted that people directly involved with the experiment rated their chances 20 per cent higher than those who were not. He concluded that a substantial measure of on-site inspection is a feasible way of looking for CBW activity.

PARTY MEETING

Technology in Poland

from a Correspondent

THE recent Fourth Plenary Conference of the Central Committee of the Polish United Workers Party in Warsaw, following closely on the "Poland 2000" exhibition inaugurated by the Polish Academy of Sciences, has focused attention on technological progress and development in Poland.

Just as the "Poland 2000" exhibition concentrated largely on forecasting the progress of science and technology, so the party meeting gave exceptional importance to technological progress. Although, in the centenary year of Lenin's birth, one would expect any such conference in any Communist country to lay