

to the northern areas of Canada can be studied. The greenhouse, which is the first of its kind in Canada, will be one of several controlled environment facilities to be built for the university's department of botany at a total cost in excess of \$1 million. The other facilities will include standard greenhouses, environmental growth chambers for teaching and research, and controlled facilities for seed germination and plant propagation.

Extending over 1,384 square feet, the greenhouse will contain several rooms in which different northern and mountainous environments can be simulated, so that long-term ecological and physiological studies of arctic, boreal and alpine plants can be carried out. In addition, experiments with animals will be undertaken in the field of environmental physiology.

The first instalment of the grant, amounting to \$350,000, is to be paid during 1968-69; subject to the availability of funds, the remainder will be paid during 1969-70. Together, the various facilities will be located in and upon a new biological science building to be constructed on the university's Edmonton campus at an estimated cost of \$20 million.

UNIVERSITIES

Sweet Reason Triumphant?

AMICABLE and constructive agreement has been reached between the Committee of Vice-Chancellors and Principals (representing universities in England, Wales and Northern Ireland) and the National Union of Students (NUS) on the participation of students in university administration. Discussions were initiated between the two bodies in June following outbreaks of student unrest. A joint statement just issued is not a capitulation but it recognizes that "the form of the academic community and the role of students within it should be modified and modernized". The statement outlines the principles which should govern the decisions which must now be made in individual universities. At a meeting this week in London, Mr G. Martin, president of the NUS, said he expects that most university presidents will accept this statement although more "revolutionary" students will by definition not be satisfied, and Dr D. G. Christopherson, chairman of the vice-chancellors committee, said he was sure the universities would welcome the statement.

The statement covers three broad areas in which students should be effectively represented but in which the amount of power they exercise will vary. In the field of welfare which includes careers advice, health services and accommodation, the students should have a large measure of executive authority. In most universities students have for some time been responsible for the operation of student unions and for a wide range of extra-curricular activities. Students' views on curricula and courses should be "properly" taken into account but decisions made must ultimately be those of the teachers who "by their scholarship in the relevant field of study have proved their right to an opinion". This right is "one of the most essential of all academic freedoms" and should not be infringed by pressure from the public, the university governing body or the students themselves. Teaching methods can be effective only if feedback is welcomed. In the area involving staff appointments and promotions,

"student presence would be inappropriate" although the principles involved should be discussed.

The problem of examinations remains a vexed one. In June, the NUS demanded immediate radical reforms, but it now recognizes that extensive research is necessary before other methods of assessment which would be both valid and reliable can be adopted. Experimental "open-book" examinations, projects and methods of continuous assessment are already being tried. Probably a mixed system will be found to give the truest picture of total ability and achievement.

The question of discipline—what the standards should be and how they should be maintained—was considered. A particularly sore point for students is the universities' assumption of parental responsibility. In view of the Government's decision to make 18 the age of majority, the vice-chancellors concede that the universities should review their regulations and that their criterion should be the need to maintain the university as an ordered working community. It was agreed that when necessary the university should inform the student of an offence alleged against him, give him the opportunity to arrange and conduct a proper defence and the right to appeal to an independent body. Students should participate in these procedures.

The actual machinery for student participation will vary, but student membership of the university council and senate should be encouraged. To supplement this, staff/student committees with status equal to that of other committees of the council and senate should be developed. To make such measures work a large number of students will have to give up their time and traditional apathy for what will probably be very boring committee work.

The next step is for negotiations to begin between individual university authorities and their students. Indeed, a number of universities are already taking steps in this direction—at Oxford a committee of senior university members is considering the special problems raised by their college system and at Sussex a working party of staff and students is reviewing the regulations and the examination system is under scrutiny in the individual schools. At Keele a committee has just been set up to consider the participation of students in university affairs and staff in union affairs.

MILITARY STRATEGY

Balanced Powers

THE progress of the nuclear weapons programme in mainland China has not lived up to western observers' predictions, the Russian military seems to be moving to what the strategists call a position of flexible response, the Arab countries have been significantly re-armed after their latest defeat and Communist forces in Vietnam are now outnumbered by about five to one. Those briefly are the chief conclusions to be drawn from the assessments of the military strength of nearly sixty countries in the tenth annual issue of *The Military Balance*, now published by the Institute of Strategic Studies in London (10s.).

In 1967, western observers were forecasting that China might be in a position to deploy short or medium range missiles by late this year, but thanks to the upheavals of the cultural revolution, especially in

DEFENCE EXPENDITURE AND NATIONAL ECONOMIES

Country	Defence expenditure	Expenditure	Expenditure as a percentage of GNP		
	(US \$ million) 1968	per head 1967 (\$)	1965	1966	1967
Britain	5,450	97	6.3	6.0	5.7
France	6,104	106	5.6	5.4	5.3
Germany	5,108	93	4.4	4.8	4.3
Portugal	305	32	5.8	6.3	6.7
Sweden	1,008	125	4.4	4.2	3.9
Switzerland	415	64	2.5	2.6	2.4
Czechoslovakia	1,538	100	5.7	5.7	5.7
East Germany	1,715	62	3.0	3.3	3.7
USSR	39,780	147	9.0	8.9	9.6
Israel	628	124	11.7	12.2	13.8
UAR (Egypt)	690	21	8.6	11.1	12.7
China	7,000	9	8.5	8.9	9.2
Japan	1,172	11	1.3	1.0	0.9
North Korea	629	37	8.9	15.4	17.3
North Vietnam	500	27	19.7	23.1	25.0
United States	79,576	368	8.0	9.2	9.8

Sinkiang province where nuclear tests are carried out, and possibly because of a partial failure of the last Chinese nuclear test in December 1967, these predictions have not been fulfilled. Continuing references in the Chinese press to a second artillery and a missile launching force suggest, however, that deployment of missiles is not far off.

Information about Russian military developments is relatively easier to come by, and the past year is outstanding for the rapid expansion of the Russian ICBM force. The Russians apparently now have about 800 of these weapons, almost twice as many as in 1967, and approaching the American total of 1,054, and the newer weapons are being deployed in hardened and widely separated sites. The Russian ICBMs are generally of greater megatonnage than those of the USA, but the American Minuteman force is powered by solid fuel rockets, which give a faster reaction time than those of the Russian liquid-fuelled rockets. The United States maintains its superiority over the Soviet Union in submarine launched rockets, with about 650 against 125. The Russians are said to have deployed a limited anti-ballistic missile defence around Moscow, but the so-called Tallin Line along the eastern Baltic coast and north-eastwards is now thought not to include any ABM system.

In the past year, Russian conventional forces have continued to develop a policy of flexible response to both conventional and nuclear war and there has been a build-up of airborne and marine troops. The invasion of Czechoslovakia attests the efficiency of the airborne force, and Russian tank-landing and helicopter carriers in the Mediterranean are being watched with interest. The military balance on the ground in Europe is reaching parity; although the Warsaw Pact forces have twice as many brigades as the NATO forces and more than twice the number of tanks, NATO brigades are nearly twice the size of Warsaw Pact brigades. Thus, in terms of manpower at least, the opposing forces are more or less equal and the Warsaw Pact superiority in armour is offset by the NATO forces' superiority in anti-tank defences. In the air the roles are curiously reversed. NATO aircraft have significantly higher performance and are predominantly strike and ground attack weapons, whereas the Warsaw Pact air forces are equipped primarily for defence. Defence expenditure in terms of percentage of gross national product

(see Table) is highest in the Middle Eastern countries, North Korea and North Vietnam. In Europe the proportion has either stayed constant or dropped in the past three years, with the exception of Portugal which is paying for its colonial policy. The United States and the Soviet Union spend virtually the same percentage, 9.8 and 9.6 per cent respectively. The comparison also clearly reveals the cost of neutrality. Sweden spends more per head on defence than any other European country and Switzerland is high up in the list.

SOCIAL SCIENCE RESEARCH

No Policy Here

DURING the two and a half years that the Social Science Research Council has been in existence, selected committees and ad hoc panels of specialists have been compiling information originally intended to guide the council in its future policy. This information—which includes the views of some of the “leading workers in the field” on current research developments, likely developments in the future, research needs in terms of manpower, money and other resources and research organization—has now been published for the council by Heinemann. So far, opportunities for research in automation, international organization, political science, social anthropology and poverty have been considered. In practice, however, no doubt because of the very general terms of reference, few tangible policies emerge. When Mr Andrew Shonfield, at present director of studies at Chatham House, succeeds Dr Michael Young as chairman of the council at the beginning of January, he is unlikely to find that all his work has been done for him. The reviews do pin-point some of the problems facing social scientists and sometimes provide sensible suggestions as to how these could be solved.

There is also a common theme in several of the reviews—the complaint that social scientists have little time to spend on research compared with the time they have to spend on teaching. Also, there seems to be a need for more opportunities to establish “intellectual contact” with other workers, especially abroad. (The case for sabbatical leave is clearly emphasized.) There are several suggestions that the career structure of social scientists should be expanded; and at least three of the reviews suggest that the time has come for interdisciplinary research projects going against the grain of the traditional university set-up. Among suggestions for overcoming these obstacles is that there should be set up research units for social scientists, with emphasis on research rather than on teaching, in which people from various disciplines could put their heads together over the solving of problems. The council is also urged to bring pressure to bear in the provision of better library facilities, and the co-ordination and exploitation of research data.

HYDRAULICS

Along the Seaway

ONE of the longest hydraulic models ever built is being put together at the Department of Mechanical Engineering of the National Research Council in Ottawa.