

sure tubes. These offer the 'leak-before-break' safety features which people feared might not occur with the pressure vessels of the PWR.

All the components of the SGHWR, except for the heavy water used as a moderator and perhaps the zirconium pressure tubes, can be made in Britain. Mr D. R. Smith, chief SGHWR engineer with the Nuclear Power Group, said that there would be few scaling-up problems except perhaps with the calandria tank surrounding the radioactive fuel elements. If the first orders were placed fairly quickly, as promised by Mr. Varley, building could start next year. Prospective sites include one at Torness in Scotland, for the South of Scotland Electricity Board (SSEB), and at Sizewell in Essex for the CEGB. Mr Smith thinks that the reactor could be completed.

The satisfactory Canadian experience with the similar CANDU reactor was probably a major factor in Mr Varley's decision. British experts who visited Canada recently were enthusiastic and close cooperation with the Canadians is expected. For the present, until the British programme is expanded, heavy water for the reactors will be imported from Canada. As soon as the SGHWR programme proves its worth, however, a British heavy water plant is envisaged, which would take advantage of the Canadian experience.

## Money for old excavations

from Ian Caruana

THE Excavations Annual Reports, recently published by the British Department of the Environment (DOE) reveal that in at least one way archaeologists are failing to justify the additional cash they have been given in the past two years. In 1972 the annual government budget was in the region of £400,000; this year it has topped £1 million. One of archaeology's unceasing and justified complaints has been that the system of ministry grants for excavation never took account of the overriding need for publication, and financial austerity often made it a matter of necessity that an excavator spent almost all his time in the field just to make a living. It is, however, clear from the DOE's Reports that more money has not meant more publications. In fact while the number of digs financed directly by the DOE has risen steadily from under 80 in 1961 to over 200 in 1972 the number of reports published each year has remained more or less constant. The result is that there are now proportionally more excavations whose findings go unpublished than there were in 1961.

There is, however, one area above criticism—namely the permanent units

that are a developing feature of modern archaeology. (Their activities do not swell the DOE statistics because, although they receive a lot of government money, they also tap other sources and the DOE is quite happy to abdicate control in such cases.)

The Guildhall Museum's Department of Urban Archaeology in London is one such unit which, although set up only recently, has a good record. The results of two excavations from 1972, at Aldgate and Bush Lane House, were published last year. Four more reports are due out soon, one of which (dealing with work at the Customs House) took only five months to complete. Brian Hobley, the director, is responsible for a policy that ensures publication as quickly as possible. Each time a supervisor finishes a site he is immediately removed from the field and has to finish his site report before being given another site to run.

In addition the London unit is engaged in clearing the backlog of unpublished sites in the City. Through lack of resources, Peter Marsden (now Hobley's deputy) accumulated 70 sites which have so far yielded no published information about London's history. Now he faces a ten-year programme of publication—a feasible proposition inside a large unit with enough resources to back him up and to enable others to carry on with imminent excavation needs.

## Salyut and after

from Vera Rich

ALTHOUGH the flight of Salyut 3 must inevitably be seen, in the short term, as a preparation for the joint Apollo-Soyuz programme of 1975, some of the experiments included seem directed at the longer term aim of establishing a permanent Earth-orbital station, as envisaged by Tsiolkovskii, and/or long term deep-space missions.

Accordingly, one of the major tasks of this mission is the testing of the life support systems, including the heat regulation system "in various regimes", and the regeneration of water from atmospheric condensation. The medical tests, effected with the multipurpose "Polinom-2M" apparatus, include the investigation of haemodynamics (the state of the circulation and the "rate of propagation of pulse waves along the arteries"), the ventilation of the lungs, and the collection of samples of exhaled air for subsequent laboratory analysis. It is intended to use the respiratory data to calculate the energy consumption in performing various tasks under weightless conditions—results which could be of considerable importance in planning the nutritional

requirements of a fully operational long term station or mission.

What these tasks are, either in the present mission or in future plans, is so far not entirely clear. The TASS reports, as ever, are tantalisingly brief, stating in this case, that the cosmonauts have "begun to test the possibility" of manufacturing hitherto unknown substances. A hint from the mission control station suggests that these may include steel "lighter than wood", and glass/metal alloys. In view of this brevity, speculation would seem fruitless at present.

Nevertheless, this type of experiment does suggest the Tsiolkovskii concept of a fully operational and self-maintaining orbital station, utilising the space "environment" for technology as well as research work. Although Tsiolkovskii's belief that the creation of such a station would be a necessary preliminary to any lunar or deep-space mission has been superseded by subsequent technology, Tsiolkovskii's name still exerts a considerable charismatic effect on the Soviet space planners. It is perhaps significant that, in a *Pravda* "background article" to the present flight, Candidate of Sciences N. Pisarenko of the Institute of Space Research of the Soviet Academy of

Sciences, discussing the radiation hazards of long term flights, states that primary cosmic radiation of galactic origin would, in the present state of the art, form a definite barrier to any manned Mars mission. He notes that "ways of overcoming this barrier" are being investigated, including "study of the self-shielding, restorative functions of the human organism and possibilities of intensifying them by the use of pharmacological preparations", as well as improvement of the shielding of the spaceship itself. For orbital stations, however, the hazard is considerably less, since according to estimates obtained from the data of Kosmos satellites, at the altitudes at which space stations operate (apogee of up to 500 km) cosmic radiation of solar origin is virtually absent and galactic primary cosmic radiation reduced by some three or four times in comparison with the deep-space value.

Both types of protection received an unexpectedly severe test when a solar flare occurred during the flight. According to TASS (July 15) "some physicists" wished to recall the cosmonauts. But it was decided that the Earth's magnetic field would protect them from the worst of the radiation, and they were instructed to use their antiradiation drugs.