

Bonn Conference (November 11). The committee started work in Brussels on Wednesday (October 16). Grudgingly, the British Government finally decided to send a delegate. Nominations had to be in by Saturday, 12th, and decision was reached only at the last moment—late Friday—after 10 days of Whitehall discussions on the point following the failure of the British move at the ELDO ministerial meeting in Paris. This aimed to link an ELDO solution with discussions for a larger framework of European technological collaboration. The German resolution adopted, with British and Australian abstentions, limited the Brussels committee's work to European space problems. The Ministry of Technology, the front-runner in these manoeuvres, seems only concerned that the collapse of ELDO (and the waste incidentally of at least £170 million spent by the British taxpayer alone) should not be blamed on Britain. It has an uphill task. Impressions from the Paris meeting were that the five continental member governments of ELDO already had a blueprint for Brussels so that the committee would be little more than a rubber stamp. The Government's face-saving efforts would not be helped if Britain made no effort to modify the talks by joining in.

#### UNIVERSITIES

### Science Surveyed

OFFICIAL circles in Oxford might well be advised by some of the student opinions aired in the survey of conditions and courses carried out by *Zenith*, the university science magazine, and the University Scientific Society (*Static or Dynamic? . . . a Survey of Oxford Undergraduate Science*, 3s. from *Zenith*, University Museum, Oxford).

Answers to a questionnaire sent to a third of all science undergraduates revealed several areas of dissatisfaction with courses and syllabuses, although not all felt as strongly as the physicists and engineers, of whom a fifth and a third respectively would prefer to have gone to another university. Many of the complaints concerned practical courses, which are often badly organized and uninteresting, frequently in the first year being little more than a repetition of school work. Many experiments in physics consist solely of reading instructions, making the apparatus work and putting numbers into formulae, which is time consuming and not necessarily instructive.

There was considerable enthusiasm for a general broadening of courses. Forty per cent of chemistry undergraduates would prefer to do a joint course if this was possible. The most popular subject for a joint course was economics (one seventh of chemists would like to be able to do this). Other suggestions were business studies, philosophy, psychology or more biologically slanted subjects. Sixty-one per cent of physiologists would also like courses in non-scientific subjects, especially German, Russian, economics and sociology, provided they were voluntary and without examinations. Perhaps the new courses in physics and philosophy, and mathematics and philosophy will go some way to serve this need for broader courses.

There is also considerable criticism of lecturers, many of whom are said not to be up to their tasks, being unable to hold an audience or to communicate ideas concisely and coherently. Apart from laziness, bad

lecturers was the only reason given by students for not attending lectures. The most popular remedy for this was fewer lectures—given by the best lecturers—and more informal classes and seminars to supplement tutorials.

#### RARE EARTHS

### Semiconductors by Gaslight

A NEGLECTED corner of the periodic table, the rare earths, came into the news on Monday when Thorium Ltd started operation at Widnes of its £500,000 plant for purifying rare earth oxides. It is the largest rare earth plant in the world, and will substantially increase world supplies of neodymium, lanthanum and praseodymium. The plant depends on a countercurrent distribution process. An aqueous solution of rare earth nitrates flows through a series of mixing chambers against an opposite current of tributylphosphate: by recycling material through the plant, levels of 99.99 per cent purity are easily obtained.

The whole operation provides something of a textbook model for the translation of research into production. Other methods of refining rare earths—fractional precipitation and ion exchange—are not fully satisfactory and, in 1961, the research staff of Thorium Ltd—25 per cent of the company's personnel—began to investigate the possibilities of countercurrent distribution. By 1964 they had a commercially viable process, and they began to have an edge in the world market over their main competitors in the United States and Japan. Some vigorous work in the patent office has made it possible for them to sell the process, under licence, to firms in the United States and Japan, under an agreement which forbids these firms from exporting any of their production outside their own territories. The process earned the firm a Queen's Award for Technology last year, and the overseas business that came in its wake earned them a Queen's Award for Exports this year. Since 1965 the firm's turnover has doubled while its exports have quadrupled.

Thorium Ltd's new plant has a productive capacity far in excess of current needs, but the firm's marketing staff are confident that sales will expand in step with production. The optical industry already uses lanthanum oxide in high quality lenses, while praseodymium oxide is the basis of a brilliant yellow pigment for ceramics. Too much neodymium oxide is made at the moment, but the unique optical properties of the material arouse the company's hopes that glass manufacturers will take it up as a decolorizing agent. It has a sharp absorption band which accurately cancels the yellow colour of iron traces in glass.

The ore that feeds the plant, bastnaesite imported from California, is a source of more exotic rare earths as well, and Thorium Ltd has managed to find markets for some of these. Europium is apparently unobtainable as a red phosphor in colour television tubes, yttrium is used in laser garnets and gadolinium has potential as a quenching metal in nuclear reactors.

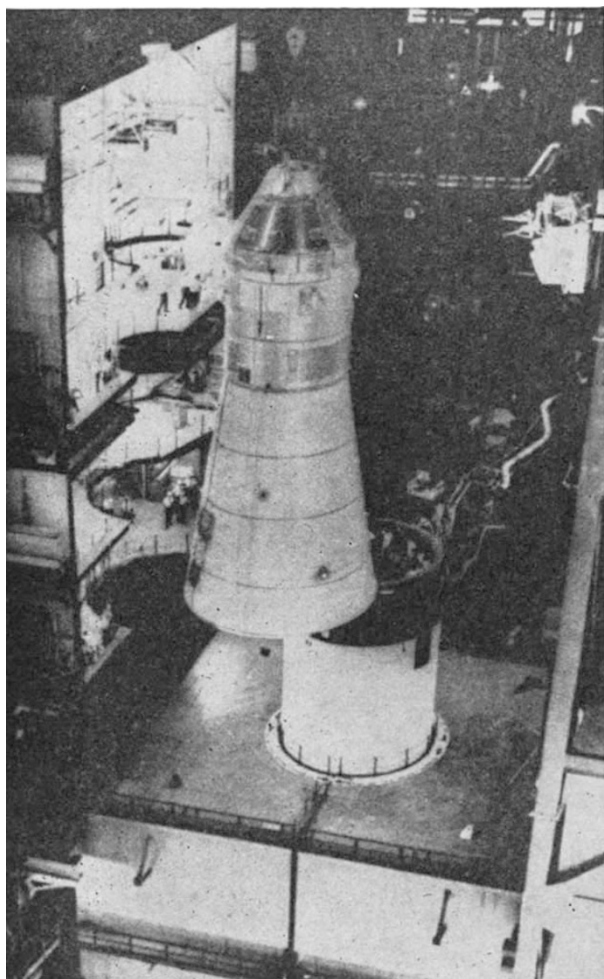
The electronics industry is a willing accomplice in the efforts of Thorium Ltd to find uses for even the more obscure of the flock of elements. The bizarre optical and magnetic properties of the rare earths will no doubt be a strong selling point. At the same time,

Thorium Ltd is aware that the advance which is the foundation of their present success could any day be followed by another advance which unseats them. The company is therefore planning to diversify. It still finds a ready sale for thorium oxide in gas mantles, chiefly in the Far East.

## ROCKETRY

### Space Race Hots Up

WITH a sigh of relief, the United States last week launched the first manned Apollo spacecraft—a series which, with luck, will culminate in a manned landing on the Moon next year. Although last week's launch was in essence planned many months ago, it will be seen by Americans as an answer to the Russian achievement only three weeks earlier of sending the Zond 5 probe on an orbit around the Moon and its recovery in the



Indian Ocean. With the recent resignation of NASA's chief administrator, Mr James Webb, and the cuts in NASA's spending which triggered off the resignation, the latest Russian effort caught NASA by surprise. If all continues to go well with Apollo 7 after what seems to have been a virtually flawless launching, American hopes will be uplifted.

Meanwhile, conjecture about what the Russians were up to when they launched Zond 5 continues. In

*Science* last week (162, 245; 1968), Merton E. Davies, of the RAND Corporation and Bruce M. Murray, of the California Institute of Technology, argued that Zond 5 may have as much significance as the precursor of an entirely new and sophisticated type of unmanned planetary probe as it has as a test for a manned flight around the Moon. Their conclusion is based on an article by Professor A. Dmitriyev, reported in *Red Star* and in *Pravda*, which praised Zond 5 as a major advance in space technology relevant to the exploration of the planets. This was because the study of planetary surfaces requires the delivery to scientists on the Earth of detailed photographs and the like which could be seriously distorted if transmitted by radio. Zond 5 was therefore intended to develop ways of returning information from space directly to laboratories on the ground—a task which, Professor Dmitriyev wrote, was successfully completed. Davies and Murray add that a drawing of Zond 5 published with the article together with a verbal description lends weight to their argument. The spacecraft had large solar panels reminiscent of those on earlier Russian planetary probes, and was fitted with a very large high-gain antenna more in keeping with a planetary than a lunar probe. Because of this, Davies and Murray expect the Russians to launch a Mars probe similar to Zond 5 on the next favourable occasion, which will be during late February and early March.

Most American space scientists have nevertheless regarded Zond 5 as a threat to their aspirations to land on the Moon first, even though there was no indication during the flight of Zond 5 that the Russians yet have the capability of doing anything more than a manned circumnavigation. But because the conventional interpretation seems to be that such a Russian manned flight is imminent, the Americans are hoping to stretch the next Apollo flight (Apollo 8), scheduled for December, to include a trip around the Moon. A flight including ten lunar orbits is technically feasible, circling the Moon at a height of about 110 km. Much depends on the interpretation the acting administrator of NASA, Dr Thomas Paine, puts on the success of Apollo 7. Following Apollo 8, two further Apollo flights are planned before the attempt at a lunar landing by Apollo 11, late next year if all goes well.

## WEATHER COMPUTERS

### New Machine for Bracknell

THE Meteorological Office at Bracknell is in the market for a large computer, several times faster than Atlas, for delivery in the early 1970s. For a cost which is expected to be about £3 million, the Meteorological Office hopes to buy a machine which will speed up the process of numerical weather prediction forecasts for a larger area and make the forecasts more detailed. So far, the operational requirements of the new system have been drawn up and an order will probably be placed with one of the five principal manufacturers of large computers early next year.

Since 1965, the Meteorological Office has had an English Electric KDF 9 computer, which recently has been operating for virtually 24 hours a day. The Atlas computer at the Science Research Council's computer laboratory has also been used for experiments on numerical weather prediction. This involves