

research experience is not as good as it might be. Thus, in Dr Lithwick's view, what is needed is a fundamental reassessment of university policy coupled with an increase in investment, particularly from industry.

There are, however, signs that the National Research Council of Canada, at least, is moving in the right direction. In 1962, the council set up an Industrial Research Assistance Programme, which is intended to stimulate industrial research by sharing the cost of specific projects. The programme last year received \$6 million from the NRC. Students are also being encouraged to carry some of the fruits of their knowledge into industry by two schemes recently launched by the NRC. In one of these, the NRC provides scholarships for students to undertake at least part of their PhD training in industry, and under the other, students can be awarded a grant for postgraduate studies which they can take up after a period of time spent in industry.

Merely persuading more scientists to take up industrial careers, however, will do little or nothing to improve Canadian science because there is no shortage of scientific manpower. The evidence for this assumption comes from a comparison of the salaries of scientists and non-scientists, and it seems that scientists and engineers employed in research and development earn significantly less than their colleagues who leave the laboratory bench for the office desk. The chief factor militating against industrial research and development, in Dr Lithwick's opinion, is the conservatism of Canadian industry, coupled with the smallness of the average Canadian firm, and the whole situation is exacerbated by the strictures on the flow of ideas between sectors and the relatively cheap technology that can be imported under licence from the United States.

The role of foreign ownership also passes under Dr Lithwick's critical eye, and he comes up with conclusions which run contradictory to popular beliefs about the economic effect of foreign firms on a national economy. According to the data given on Canadian industry, it seems that far from reducing the level of research and development carried out in Canada, subsidiaries of foreign—predominantly American—firms are among the most intensive performers of research and development. Thus, Dr Lithwick is able to conclude that "foreign ownership cannot be seen as a source of economic problems resulting from R and D activity".

Canada has failed to harness science to economic growth or to solving social problems, and because there is no science policy coupled with national goals, "areas of economic activity crying out for technical breakthroughs will remain in the backwater". Decisions about allocation of resources are in the hands of scientists, and until there is a coherent science policy, "stress will be placed on the new frontiers of science such as intense neutron generators and space research, because the alternatives lie outside the ken of this elite".

The plethora of papers on science policy which have appeared from the National Research Council and the Science Council of Canada bear witness to this preoccupation with organizing science and technology. Such savage criticisms of Canadian scientific decision-making are likely to be taken to heart by an administration which places considerable store by its efficient management of its scientific affairs.

CANADIAN ASTRONOMY

Down Mount Kobau & Up Again

Two crucial reports which form the background to the present state of Canadian astronomy have been published by the Department of Energy, Mines and Resources which conducts Canadian optical astronomy and some of Canadian radio astronomy. The chief recommendation of the first report was for a Canadian optical telescope to be built in Chile using the 157 inch mirror blank prepared for the Queen Elizabeth telescope on Mount Kobau in British Columbia. The report, prepared after doubts were expressed about the merits of Mount Kobau, supported these criticisms on the grounds that many astronomers in eastern Canada would not find the journey to Mount Kobau worth while because of the low probability of good weather conditions, so that it would not be a truly national observatory. This is particularly so for photometric photometry—the report estimates that only 300 hours of photometric work per year could be carried out from Mount Kobau, compared with 2,175 hours in Chile. The Queen Elizabeth telescope project, which reached the stage where a road was built up Mount Kobau before the doubts made themselves felt, was started at a time when the fiction was rife that a big telescope could not be built on foreign soil. But a second recommendation, which would have come into play if a suitable site could not be found in Chile, underlined the importance which northern astronomers attach to having an observatory in the southern hemisphere. This was to complete the Mount Kobau instrument, and join with the Carnegie Institution in constructing a 200 inch telescope in Chile—the CARSO project.

What then happened was that the Federal Government vetoed both schemes. But several universities, chiefly in western Canada, set up a consortium with the intention of themselves completing the Mount Kobau telescope. A study reconsidering the CARSO project was initiated which reported last autumn, and this is the second of the reports, now published because of the interest expressed by Canadian astronomers. What this second report recommends is that Canada now joins the CARSO project of the Carnegie Institution, subject to certain provisos. Clearly the facilities built up to handle the 157 inch mirror blank of the Queen Elizabeth telescope have become something of an embarrassment and both reports are concerned about making full use of the optical expertise that has been established.

The cost to Canada of the CARSO project, according to the report, would be \$12 million in ten equal yearly payments beginning next year. This would be the most economical way of satisfying the need for the large optical telescope, the report says, echoing some of the conclusions of the earlier study on the merits of the Mount Kobau site.